July 1980

Smithsonian

Mexico's tumultuous revolution (p. 30): here, a young soldier for Pancho Villa

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The distinguished panel of renowned music authorities which participated in the selection of these great recordings considered *countless* recordings of each work. For instance, panel members reviewed 24 recordings of Beethoven's 7th Symphony and chose the *one* superior to all others: Toscanini with the New York Philharmonic. From 30 recordings of the 'Nutcracker Suite,' they selected the *one* greatest: Arthur Fiedler and the Boston Pops. Similarly, the recordings of other great symphonies, concertos, sonatas, rhapsodies, ballet and vocal music were reviewed and the most outstanding in each instance recommended by the panel.

The creation of this definitive collection has been made possible with the cooperation of leading record companies both here and abroad. They have made available the superb original recordings of their most famous artists, orchestras and conductors. And now, *The 100 Greatest Recordings of All Time* is being issued by The Franklin Mint Record Society.

The works chosen include masterpieces by Beethoven, Brahms, Mozart, Verdi, Dvořák, Schumann, Copland, Mahler, Tchaikovsky, Debussy, Rachmaninoff—performed by such giants as Horowitz, Heifetz, Caruso, Cliburn, Watts, Stern, Rubinstein, Menuhin, Serkin, Ponselle, Schwarzkopf, Price—with great orchestras under the direction of Toscanini, Solti, Bernstein, Ormandy, Stokowski, Beecham, Walter, Fiedler, von Karajan and others.

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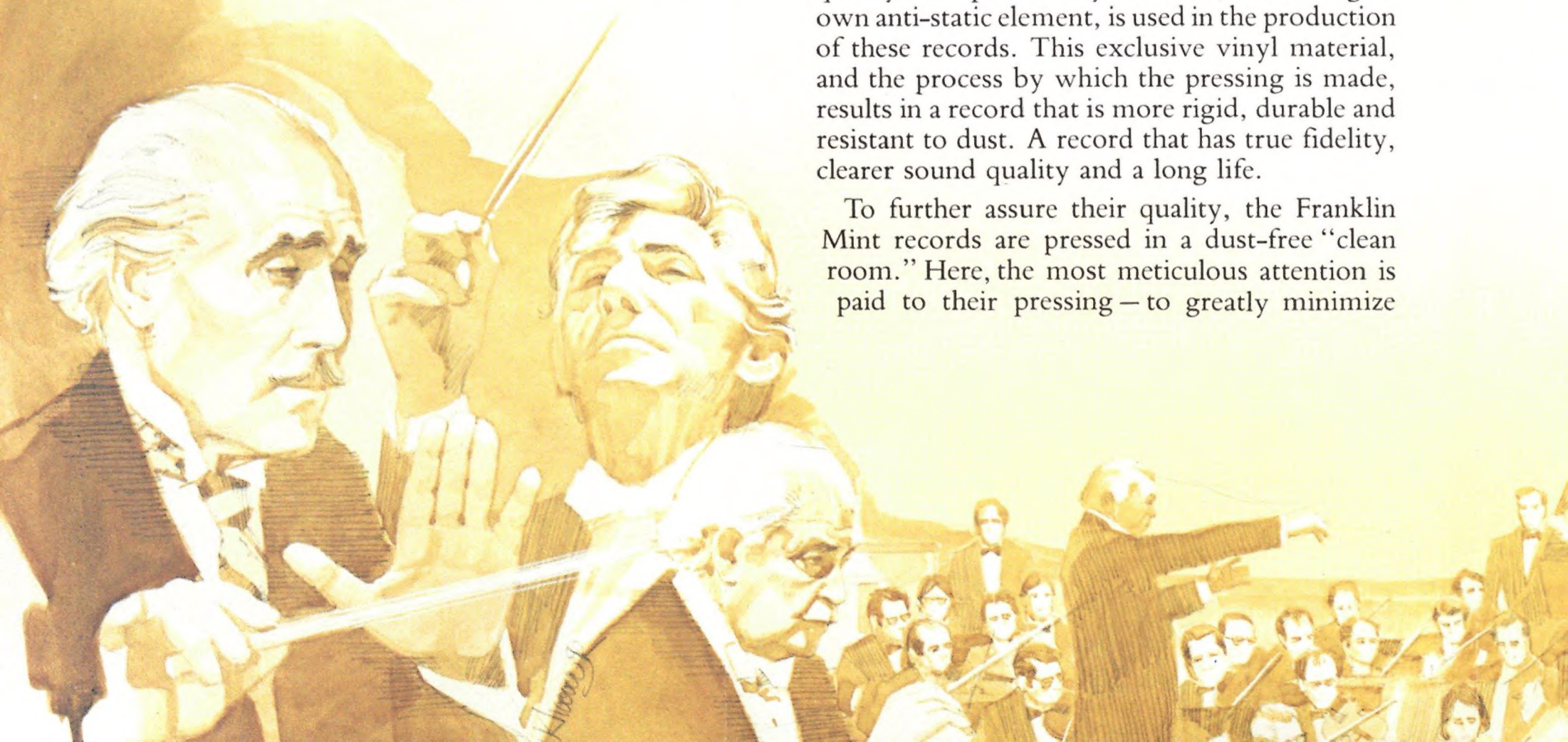

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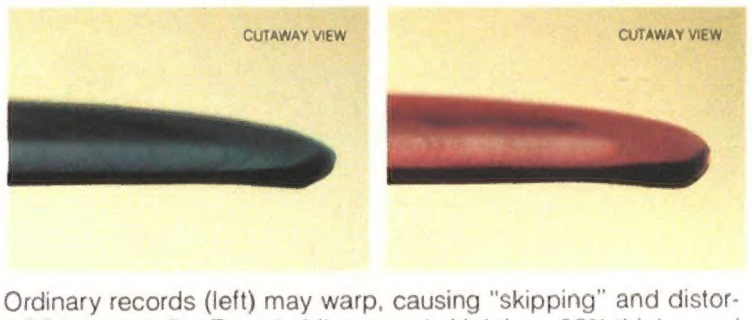

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Secretary Ripley's comments

The view from the castle

Our proper concern for endangered species is not matched by that for Native American archaeological sites, now fast disappearing

The Tellico Dam in Tennessee is already famous (or infamous if you like) for the tiny snail darter, the endangered minnow-sized fish that held up the mammoth project for two years until the Congress overruled the courts. What has not been mentioned so frequently is that the construction of the dam will cover some 300 archaeological sites. Various Native American tribal groups, environmentalists, historians and archaeologists could never summon the same amount of public concern as could the advocates of the snail darter.

This is true all over North America today, from the agricultural lands of Mexico to southern Canada. Everywhere, especially in river bottoms and fertile farmlands, there are prehistoric sites, some of which go back to the Pleistocene. On government-owned land there is some chance of saving such sites before construction takes place, and indeed much archaeological exploration has been carried out, although spottily and unsystematically. Often it has been "urgent archaeology," a few hours ahead of the bulldozers rushing to build another water impoundment or highway.

The Smithsonian Institution's first publication was *Ancient Monuments of The Mississippi Valley* by E. G. Squier and E. H. Davis (1848). We are still at it. One of our archaeologists, Bruce Smith, is a specialist on the Temple Mound builders of the archaeologically rich Mississippi Valley. He estimates that the rush to agriculture, road- and dam-building is so great that in 20 years all traces of prehistoric occupation in these deposits will have been destroyed. We know that these tribes, living between A.D. 800 and 1600, had a rich culture, with hunting-gathering and domestic crops providing abundant supplies for an elite group.

For a number of years after World War II, the Department of the Interior supported excavation teams and technicians who sampled sites doomed by pending dam construction. In the late Sixties the budget for this work was abandoned and the formal effort dispersed. It is indeed sad, now that our consciousness of the past has begun to reemerge.

The jigsaw puzzle of evidence is particularly threatened on private lands. Here, technology allows farmers to level off mounds without care or heed—instead of going around them as in China (where in the last ten years some of the most striking discoveries in archaeology have been made).

Recently, however, a certain amount of mound robbing has come into fashion with the realization that the objects found may be turned to a profit. Complete pots, wooden artifacts (found in dry cave deposits), metal or stone tools, beads—all these have commercial value, little appreciated in past years. Not long ago one prehistoric pot sold for $30,000, an incredible sum and one likely to encourage what is really homegrown vandalism.

History lies all around us in pieces and tattered fragments, destroyed by the descendants of those who made the history. Would that archaeology could acquire the same respect here that it has achieved in other areas of the world such as Egypt, the Middle East, Middle America, China—to which we travel as eager tourists, ignoring our own heritage in the process.

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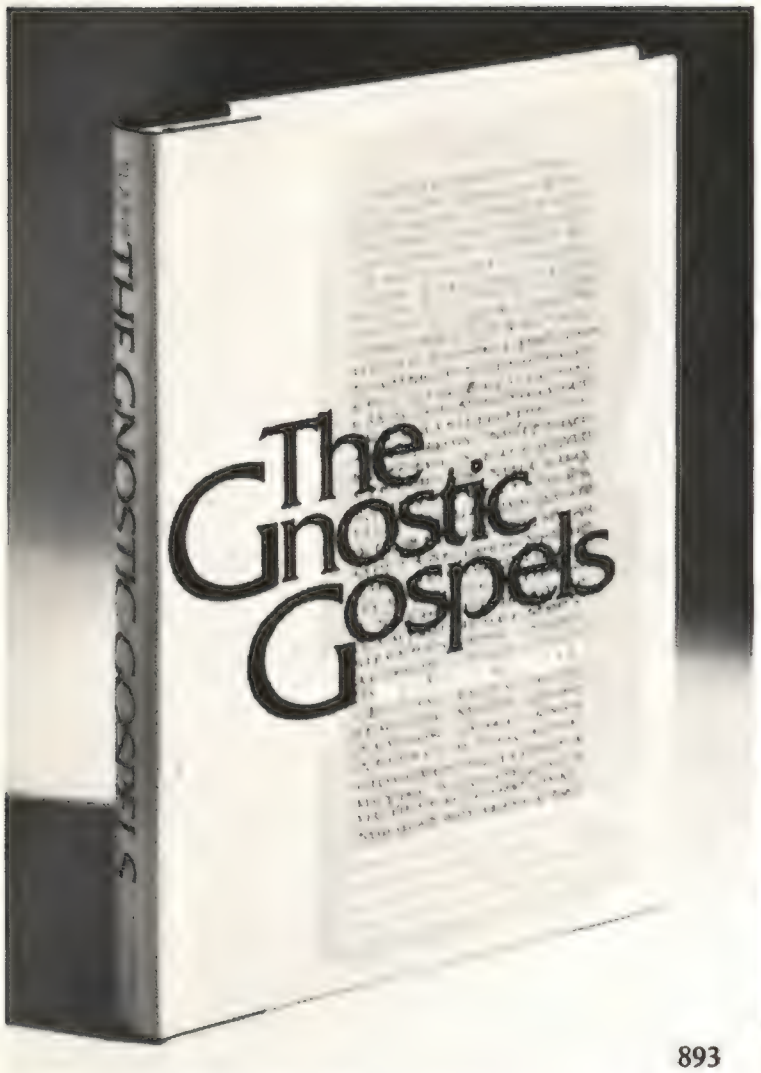

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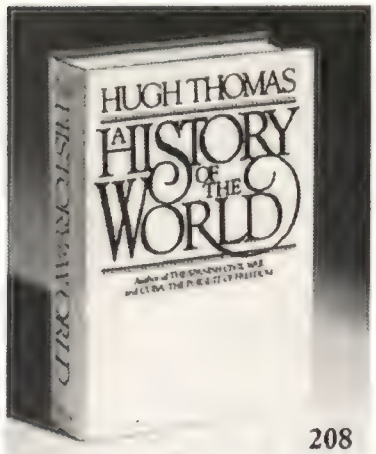

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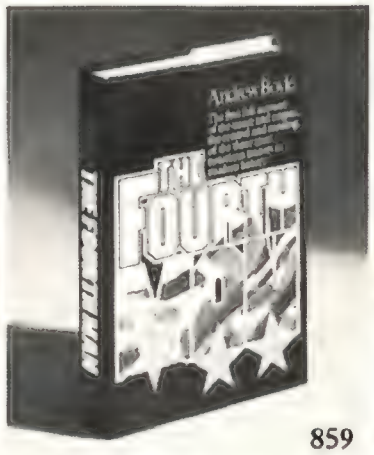

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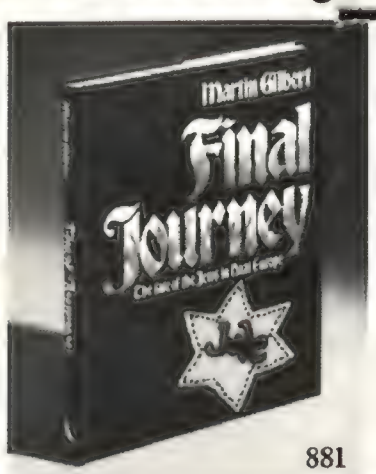

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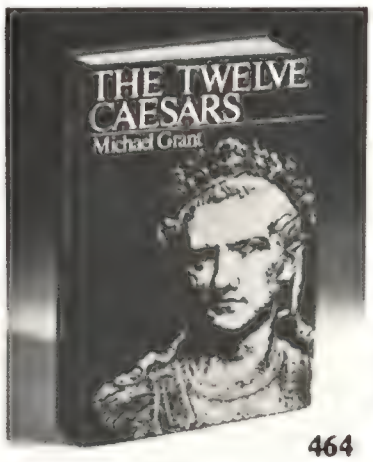

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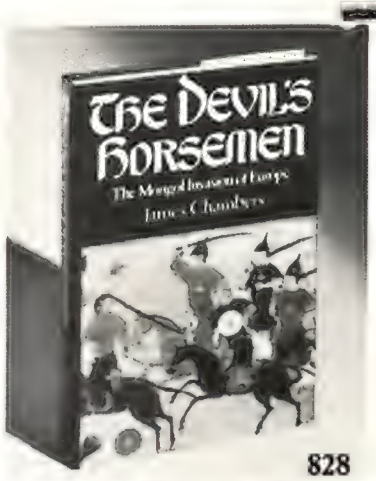

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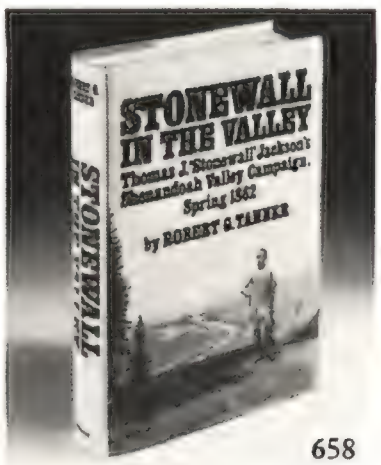

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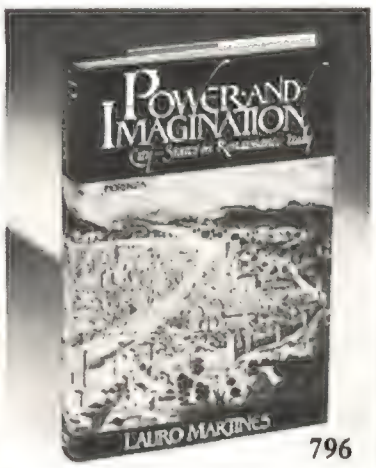

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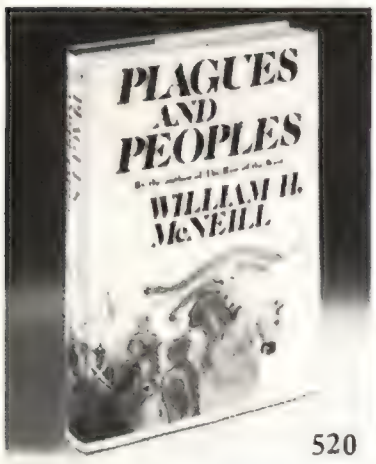

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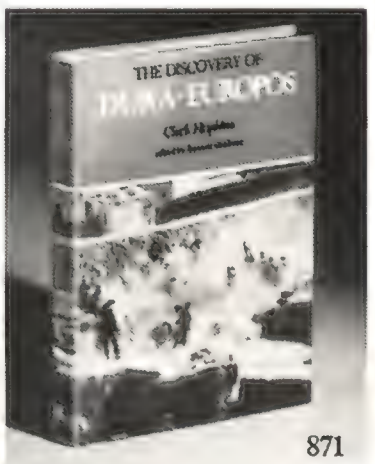

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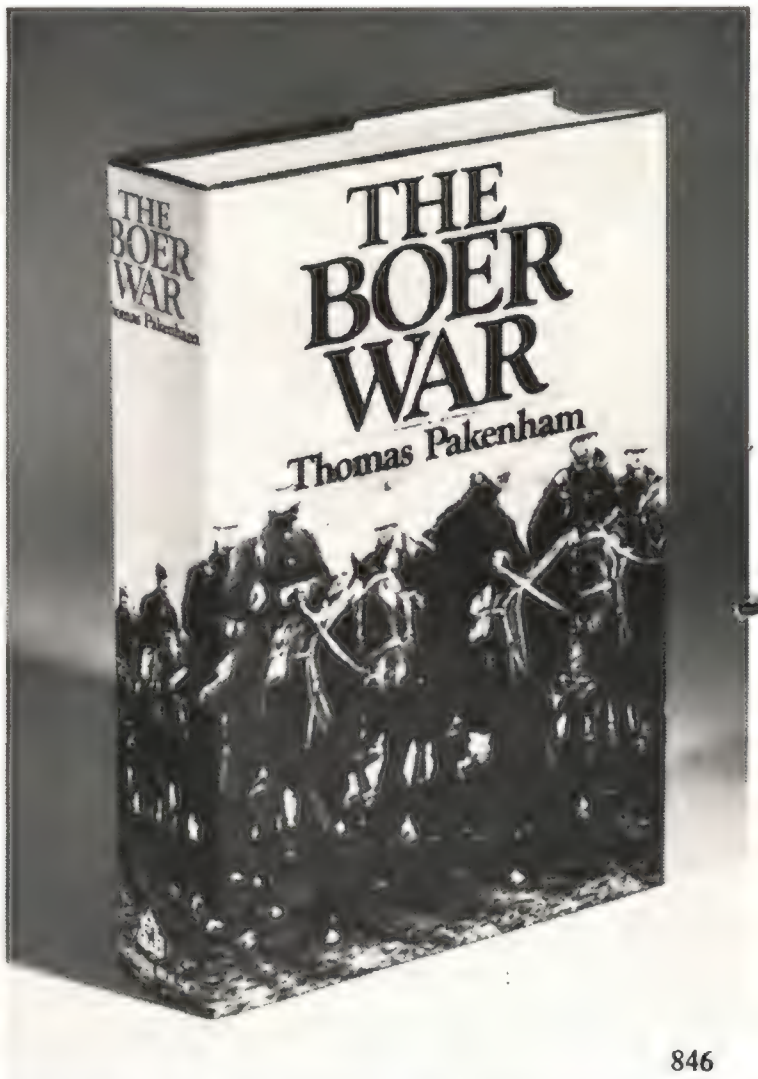

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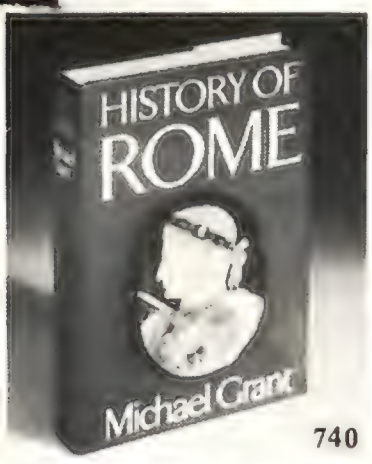

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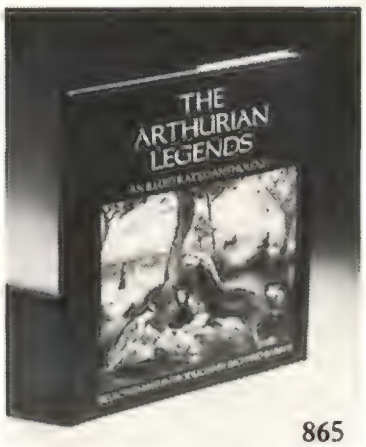

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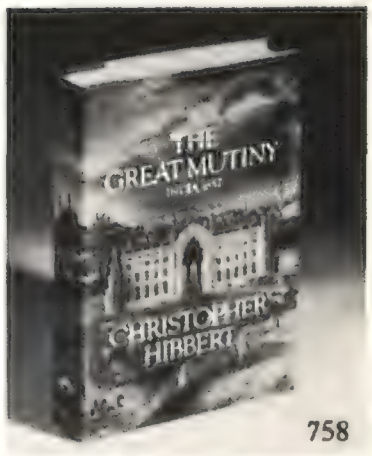

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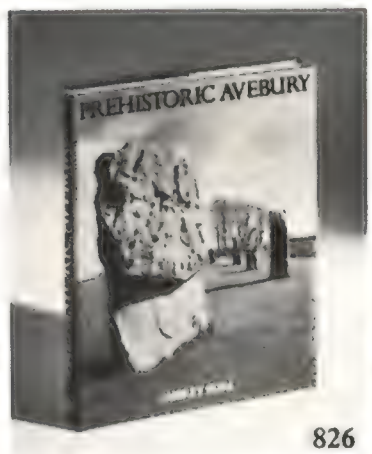

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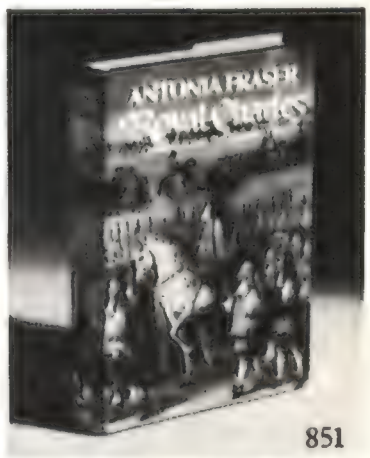

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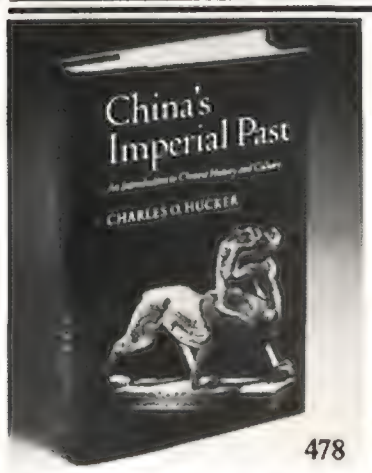

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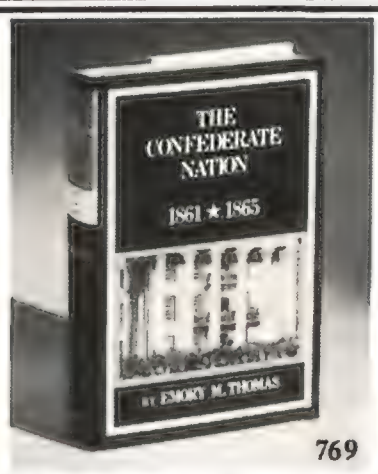

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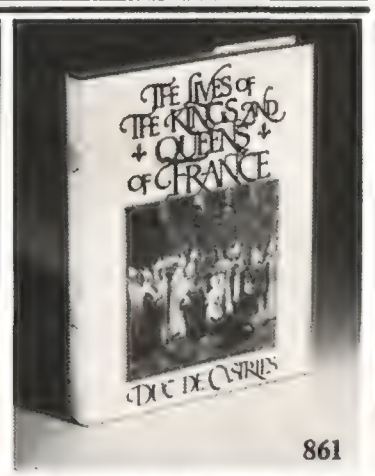

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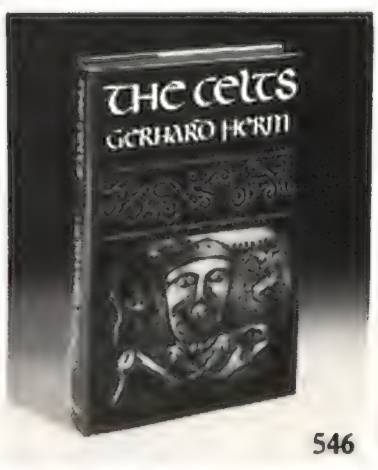

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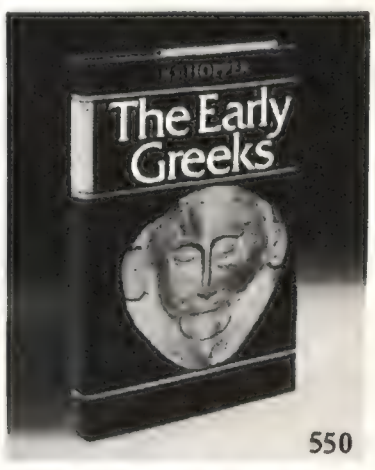

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Letters to the Editor

Air safety

Dear Sir: As a private pilot who is concerned about air safety, I found Percy Knauth's article, "Seeking a solution to the danger of collisions in the crowded skies," in your May issue very disturbing. His oversimplified view of this complex problem serves only to stir up unwarranted fear and antagonism toward the private pilot. Contrary to Knauth's claim, the traffic controller's word is *not* law; the ultimate responsibility for flight safety does rest in the cockpit.
Donald A. DaDeppo
Tucson, Arizona

Dear Sir: Opposition to the FAA's plan is not an attempt to halt progress, but an attempt to stop the introduction of overly complicated control schemes. These will probably lead to more situations similar to the San Diego disaster, where, in spite of both pilots being under instrument flight rules and being directed by an FAA controller, they were expected to "see and be seen." The irony is that the expanded FAA plans are so complicated that neither pilots nor controllers will be able to handle such requirements.
R. Reams Goodloe jr.
Kent, Washington

Dear Sir: This country was built by the spirit of the private pilot—individualistic, adventurous, willing to take calculated risks and make sacrifices of money and effort for the sake of freedom, beauty, excitement, hope and the feeling of being somebody special.

If this country lets the FAA kill off the private pilot, it will signify more than the end of small airplanes. It will be the death knell of the American spirit itself, the advent of the humanity of 1984.
Harry F. Noyes III
Westland, Michigan

Dear Sir: General aviation is a continuing source of new pilots and new customers for the manufacturing and service branches of aviation, so that the industry can stay alive between wars. It should not be stifled on the basis of horror stories and body counts.
John Woodford
Shorewood, Wisconsin

Dear Sir: My husband is an Approach Controller with the FAA in a nonradar environment, controlling planes into and out of 12 different airports. This is accomplished by using mental images of the constantly changing traffic situation and basing control instructions solely on *reported* positions of known aircraft. Often reports by pilots are sloppy because they think they are being watched on radar. That is a dangerous assumption.
Georgia Brooks
Fayetteville, Arkansas

Dear Sir: In fairness, I think Mr. Knauth could have pointed out that student pilots are prohibited from flying solo to and from virtually all the nation's large airports—Atlanta, Chicago, Kennedy, LaGuardia, Newark, and Washington National, to name only a few.

Unlike the example of a pilot who has $80,000 of the latest equipment but chooses not to use it, most of us use all the equipment we have whenever it can be of help—it makes flying safer and more convenient. Because we are generally a bit gadget-crazy, we love to play with our electronic toys.
Peter Michael Skov
Reston, Virginia

Dear Sir: As an airline pilot and general-aviation pilot, I have interests on both sides of the battle for the skies. However, it is refreshing to see in print a forthright prediction of what must be, and what is already upon us. The days of uncontrolled pleasure flying through large, very busy, terminal airspace has gone the way of the barnstormer.

Actions such as reliever airports, more positive control, airborne collision avoidance, stricter pilot requirements and tougher enforcement against violations are needed. These can be worked out or forced upon us. General aviation does not have to lose out—it's up to them.
David Miller
Visalia, California

Old patriots' bones

Dear Sir: It is very likely that Mad Anthony's remains will remain scattered. Wayne, being Pennsylvania's foremost military man of the Revolution, is the subject of a number of local legends that add to James V. Murfin's story of Wayne's double burial.

It is held that son Isaac Wayne stopped in a Paoli tavern on his return journey from Erie bearing his father's bones. While Isaac was inside the inn, someone broke open the container that Wayne had in the carriage. Without noticing that it had been tampered with, the younger Wayne resumed the final leg of his journey. It was not for several miles that he realized that the bones were being scattered in his wake. Thinking of the crowds awaiting him for the funeral, Isaac saved the situation but further confused Mr. Murfin's story by making up the difference in bones using some scattered sheep bones lying about in a nearby field. But at the churchyard, everything was interred with proper ceremony.
John H. Ansley
Devon, Pennsylvania

Dear Sir: Mr. Murfin might well have added to his account of the travels of General Nathanael Greene's remains those of one under his command from another plantation Greene owned after the Revolution. The place was Dungeness, on Cumberland Island, Georgia. The remains were those of General Henry (Light-Horse Harry) Lee, who died at Dungeness in 1818. The remains were carried to Washington and Lee University in 1913 to lie beside those of his more famous son, General Robert E. Lee.

You have driven me, as a loved nurse from my childhood used to say, "plumb ravin'-'stracted" trying to recall two lines from *Everybody Works but Father* that simply will not come back to me.

Everybody works but father;
And he sits around all day
Feet in front of the fire,
Passing the time away.
(Those two missing lines)
Everybody works in our house
But my Old Man.

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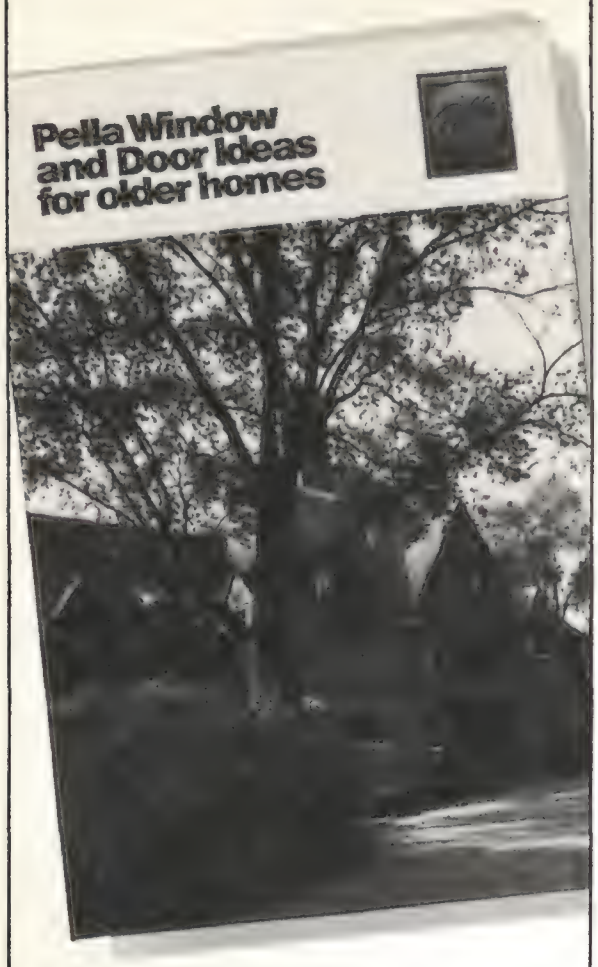

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Carp

Dear Sir: Your article on carp excited some fond memories of my days in Omaha from 1955 to 1963, when I could go to Joe Tess' Place for carp sandwiches. That was the best fish I've ever eaten. And the restaurant is still going strong under current owner Bill Falt [see below].

Joe would bring in live carp from the Missouri River nearby and dump them into a big tank. After a week, the fish were transferred to a second tank of fresh water. By then, the carp had lost any muddy taste they may have had, and they were cut up, deep-fat fried, and offered with a couple of chunks of crusty bread and some cole slaw as a "fish sandwich."
Harry W. Johnson II
Tacoma, Washington

Mushrooms

Dear Sir: The reference to what is believed to be the oldest record of death from known mushroom poisoning in the United States was especially interesting to me since the victims were related to me. This William Gould was a cousin of my great-grandfather, John Gould, who had come from Devonshire, England, and was then living in Newburgh, New York.

Two small children survived this poisoning, and my great-grandfather wrote to their grandparents in England advising them of this tragedy. He received a pathetic reply concerning the orphans and instructing him about placing them aboard a ship for return to England.
Orrin J. Gould
Dexter, New York

Language teacher

Dear Sir: After having taught my weekly 25 language classes, I sank wearily into a chair to reflect upon "A manic professor tries to close up the language gap."

I'm all for anything that will encourage interest in foreign languages in a country which in general disdains knowledge of them. But why is it that no one seems to expect teachers of science to go around dressed as Pasteur, or of English as Shakespeare or of math as Pythagoras?

Clearly Professor Rassias has found *the* recipe. First give all language teachers a limit of 22 students per section, other apprentice teachers to drill them in groups of 11, and more aides to run the laboratories. Then add "new" techniques, such as using only the language being taught (called the "direct method" for decades), do simulations and skits (an old technique), and finish off with the sure-fire attractions of virtually no homework. I think Professor Rassias is a ham actor, whose "new method" consists of breaking eggs on students' heads, in a foreign-language version of *Gong Show*.
Marilyn Barrueta
McLean, Virginia

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Bell System

Phenomena, comment and notes

Thoughts for a summer beach: oldest whale fossil yet, soft water and heart attacks and sunglasses for an Asian fish

This is the first full month of summer and a proper time to be lollygagging on a friendly beach, a pastime rendered all the more satisfying because it can be done in the sure knowledge that Science labors on in our behalf even while we recuperate from a year in some ways best forgotten.

Since you are, putatively, on the beach, you may have acquired a pair of those sunglasses that are called photochromic, darkening in the sun, lightening indoors. And you may think that they are a wonderful new development but, according to *New Scientist* (February 14, 1980), they aren't. There's a fish that has been "wearing" them for years. It is a puffer fish from Southeast Asia, and its cornea, which contains a yellow pigment, is sensitive to light. As bright light falls on the eye, the pigment spreads over the center of the cornea, acting like a filter. At night, when the loss in brightness would be a disadvantage, it returns to the cornea's edge.

And fishy memory

If you really are on the beach, baking in the sun and trying to forget the tribulations of the past few months, you are doing it in a way that works for some fish.

A German scientist wondered, a while back, if body temperature had anything to do with forgetting or, more precisely, the rate at which memory is erased. She trained three kinds of fish to distinguish between symbols and then reduced their body temperatures by 18 degrees F. In two species of fish, says *New Scientist* (April 3, 1980), the lower temperature seemed to slow down their forgetting which symbol led to something edible. In the third, the minnow called *Phoxinus phoxinus,* there was no such effect. The answer lies in the apparent fact that memory has something to do with metabolism. The minnow was able to adapt to the colder water, revving up its bodily, or metabolic, functions; the other two couldn't do this. Their metabolism slowed down in the cold and along with it, whatever process erases memory.

The eye of the needle

If a better mousetrap has recently been invented, I haven't found it, but *New Scientist* (April 3, 1980) says there is a better needle now. No one will ever again have to go through the humiliation of myopically poking an unraveling piece of thread at an invisible hole. The needle, touted as the first of its kind in a conventional width, is made of two steel filaments that lie together. They are welded at one end, making the blunt part of the needle. Then they are twisted and welded at the pointy end. All you need to do is roll the needle between thumb and finger against the needle's natural twist and it opens up into a fine big eye. Released, it clamps together on the thread. Who says innovation is dead?

Don't drink the water

There is a mysterious correlation between heart disease and soft water which has been begging for an explanation—and that may now be in hand. It is not what is in the water but what is not in it—namely magnesium.

Two New York doctors have pointed out in *Science* (April 11, 1980) that the only mineral they found to be deficient in the heart samples of people who died suddenly of heart attack for unexplained causes is magnesium. Further, experimenting with pieces of coronary artery from dogs, they found that taking away magnesium causes the artery to constrict and adding magnesium relaxes it. Magnesium is in short supply in soft water.

It goes without saying that one should consult a doctor before plunging ahead with a home remedy.

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Aluminum, no

Not enough magnesium is bad; too much aluminum may be bad. This wonderful light metal, which we use for airplanes, cooking ware, window frames, roofs and other things we associate with quite intimately, has been charged in the past with being a cause of senility. Some researchers said yes, others no. But now two scientists report in *Science* (April 18, 1980) that they have used the techniques of scanning electron microscopy and x-ray spectrometry to examine the hippocampi of normal and senile brains. A sign of senility is a large number of neurons that have what are called neurofibrillary tangles. (Neurofibrils are tiny fibers in the cytoplasm of neurons.) The researchers found high amounts of aluminum in such neurons (whether from senile or normal brains) but practically none in normal neurons, regardless of their source. Whether aluminum causes the tangles or the neurons with tangles simply collect aluminum seems to be an open question, and no one is advising you to avoid aluminum—at least not for the time being.

To be a star

Before you get too forgetful, either from staying hot on the beach or associating too intimately with an aluminum pot, make a mental note to name a star when you get home.

There is an organization called the International Star Registry, located in Toronto (indeed, at 80 Charles Street West), which for $25 will give you a star to name. All just for fun, of course.

It seems that a man named Ivor Downie had the bright idea and sold it to the Toronto Festival of Festivals to which a lot of human stars were coming. They all appreciated having previously numbered stars named for them, and now the ISR is making its services available to the public. For your $25 you get a star to which you may append your own name or that of a loved one, and it is filed in a Swiss vault and recorded in the Library of Congress. You also get a chart that shows you where your star is, a booklet about the cosmos, an assurance that the star is yours forever, and a purple and gold certificate.

I'm tempted but, with my luck, I would probably wind up with a white dwarf.

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Of cabbages and whales

News for paleontology fans: a University of Michigan paleontologist has found one of the oldest whales on record, in the Himalayan foothills of Pakistan, where it had lain for some 45 or 50 million years. According to *Science News* (March 1, 1980), it died in an area that was once a shoreline, among land and sea creatures. The whale probably weighed 500 pounds and measured up to eight feet long. It may have gone into the water to feed on fish, returning to land at night.

Meanwhile, going back a bit further, *Science News* (April 12, 1980) reports that what may be the oldest fossil evidence of life on Earth has been located in Australian sedimentary rocks. Until this discovery, the oldest convincing traces of life were dated at "only" around three billion years; older claims were controversial. What they found in Australia seems indisputable; it is a cabbage-size object that is the imprint of a mat of bacterial cells. Its age: 3.5 billion years.

More TV violence

People often, and probably quite properly, associate the violence on television programs with the behavior of children, but it may not just be the fictionalized mayhem the nets are so fond of that causes trouble. It may be the news programming as well.

Scientists in Northern Ireland, says *New Scientist* (April 17, 1980), have been looking into this, monitoring the attitudes of children in a London suburb, two small towns in Ulster and a few places in Scotland (some of which get the news from Northern Ireland). Even though the children were not involved with any of the unfortunate bombings, those living in areas that got the Northern Ireland news had more violent "world views" than the other children. In a month-long check of the London news, "bomb" or "explosion" was used twice per broadcast; in the Northern Ireland news eight times per broadcast. When mention of bombs and explosions dropped to five times per broadcast in a later test, so did the violence in the children's responses. So, to the extent that television news reflects reality, reality may be bad for you.

And that, Walter, is the way it is.

—James K. Page jr.

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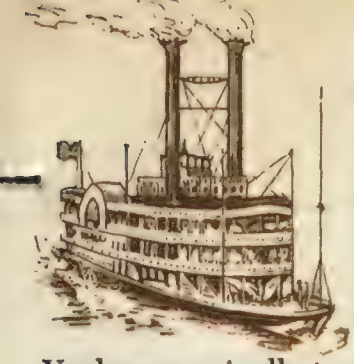

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Around the Mall and beyond

The Mall bore the weight of a wondrous amount of visitors this past spring. One reason was a vast religious gathering in late April, designed, I suppose, to offset whatever pagan rites were practiced on May Day. The meeting attracted thousands of extraordinarily well-behaved Christians, sincere and devout and lit with their zeal.

Joseph Henry's statue had to be blocked off during this great outpouring of faith, just as it was when Pope John Paul II was here last fall. In both cases platforms were constructed from just in front of the castle out onto the Mall, and in both cases, the first Smithsonian Secretary, serene beneath his patina and sublimely unaware of the starlings that nest up inside his academic gown, seemed to supervise the proceedings until structures were raised to eliminate his figure. I expect it would be pretty disturbing to try to preach a sermon with Joseph Henry looking over your shoulder.

The temporary loss of Dr. Henry's presence was offset by the delightful sight of those ubiquitous Mall joggers getting frustrated by all that construction. The whole idea of jogging, apparently, is to work yourself into a sort of trance in which you become blind to the sights around you, deaf to the shrieks of terrified mothers snatching their babies out of your path and numb to the mounting pain of your own body—the deep-seated throb of damaged kidneys, the ache of hyperventilated lungs, the torture of leg muscles, the hot sting of heel blisters.

Thus self-hypnotized, the normal swarm of joggers thundered along the Mall the

The very first stewardesses pose in 1930 uniforms.

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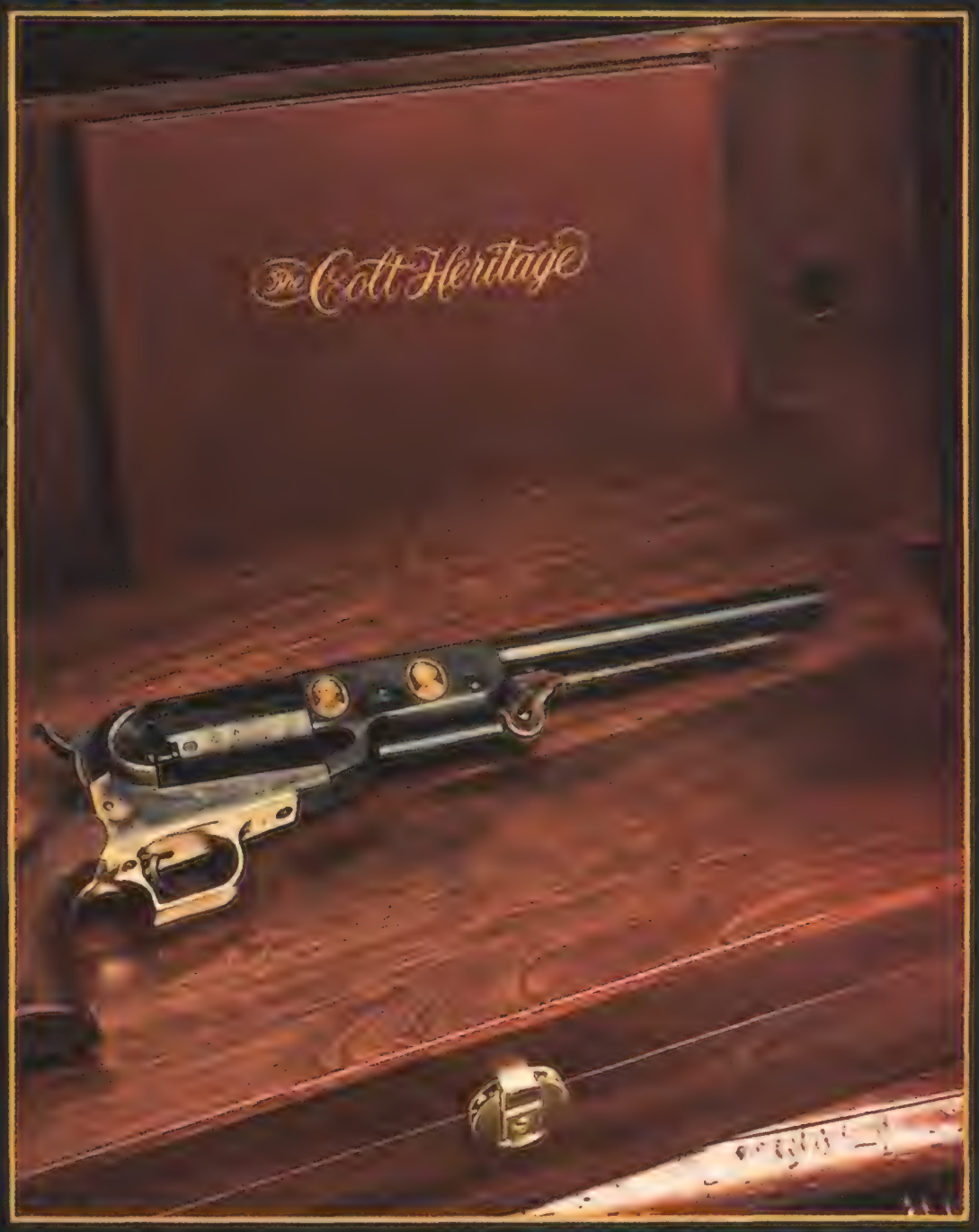

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COLT - an American heritage

day before the religious meeting and suddenly were confronted with chain-link fences, piles of lumber, stacks of plywood, groups of carpenters in hard hats. The reaction was hilarious.

One jogger never slacked his pace, but kept veering to avoid obstacles until he found himself aimed back in the direction from which he had come. His trance lifted just enough to reveal an expression of slight puzzlement as he headed back toward the shower. I can imagine his conversation with his fellow sweat hounds: "I think I did my usual three miles, but I seem to have made remarkable time."

Another runner came upon a fence and simply hopped up and down before it, jogging in place, hoping it would go away. I got tired of watching him. Anyway, I was expecting one to break into helpless sobs, bang his forehead on the ground and have to be taken off.

Such titillating conjectures were transfixing me like a jogger as I put into the Air and Space Museum to see what was planned for the Flight Attendants Exhibit. And the photographs of airline stewardesses of 50 years ago, as you can see on page 22, snap you right away from today's troubles and back to the days of Expansion. We had some very new airlines back then and we needed better service than was provided by the copilot, who sometimes glanced over his shoulder to see if anyone had jumped out.

Ellen Church, a real agitator if ever there was one, thought women ought to find jobs looking after passengers (she actually wanted to fly passengers herself, but had to settle for this). She's at the upper left of this group of original stewardesses, all nurses, dressed in capes and berets, ready to do their stuff for United Airlines (then Boeing National).

There was a lot of discussion about what stewardesses should be called, incidentally. "Flying Nurses?" No. "Hostesses?" Too much like the dames that greeted customers at a speakeasy. They settled on stewardesses, but not before some wag suggested "Flying Buttresses."

Another big deal on the Mall this spring was the tenth Earth Day. Examples of solar heat and wind power and other things we all admire and believe in were set up on the grass, just east of the Air and Space Museum, and the celebration of the simple, wasteless life was visited by

a squadron of bicyclists led by Dennis Christopher, the young actor who played the bike racer in the film *Breaking Away*. To everyone's surprise, he confessed that he really isn't a cyclist at all. What he is, of course, is a damn good actor.

I was kidnapped from my office and led to Earth Day by my friend Ted Wertime of the Smithsonian's anthropology department. He wanted me to look at a still. It was a model of a still, actually, which had been trucked to the exhibit from near Ted's home in Pennsylvania. It's designed to produce alcohol for fuel.

Since I had just been writing about steam cars and their fuel problems (last month), and since fellow columnist Jake Page had, in "Phenomena," just sounded a warning about the economics of fuel farming (last month), I was interested. I spent an hour talking to the farmer, Richard Potts, who had built the still, and getting a course in how it works.

The basic idea of cooking and liquefying ground corn and then fermenting this mash hasn't changed much in centuries. But there are some wonderful improvements that increase efficiency. Gauges maintain exact cooking times and temperatures at various levels. A separator spins off liquids and washes remaining solids, which become excellent cattle feed—18 percent protein, said Mr. Potts. Temperature of the fermenting tank must be kept within fine tolerances.

Ten years ago, Earth Day was marked by—among other things—some very tuned-out young people grabbing at every Cause that implied a protest against the way things are. Now, a decade later, the major thrust of this celebration was by very short-haired, very hard-working farmers who see in this kind of conservation and energy use an answer to practical ills.

The famous Gilbert Stuart portraits of George and Martha Washington, subject of endless brouhaha when the Smithsonian offered to buy them from the Boston Athenaeum, are now here in Washington and will go on exhibit with ruffles and flourishes on July 4. After all that publicity about the Smithsonian's "raid" on a Boston treasure (Boston's version), or Boston's long imprisonment of a national treasure (Washington's version), the dispute was amicably settled. The Institution was allowed custody for a three-year period; then they would return to Boston

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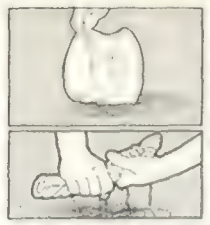

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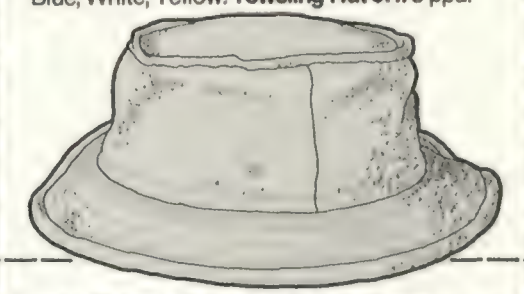

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for three years, and continue to alternate thereafter. Thus everyone in the Smithsonian and the Athenaeum went happily back to work.

As a onetime Bostonian, I have several spies in that city, and they affirm what I instantly suspected when the dispute first arose: that the Athenaeum is a nice old goofy place, pretty much like the Smithsonian. So no wonder common ground was discovered for settling the dispute.

The paintings arrived in early May to the beaming delight of Marvin Sadik, director of the National Portrait Gallery. For two months they went through a sort of rehabilitation at the hands of conservators Felrath Hines and Rosamond Westmoreland. They gave them new frames, cleaned them up, varnished them again and went through some other mysteries that weren't revealed to me for fear of passing on corporate secrets.

As the portraits arrived, so did the disclosure that the pandas at the National Zoological Park had been artificially bred. At a fascinating press conference, complete with snippets of the official film—which I suppose would be R-rated in its entirety—the media were given the true word by zoo director Ted Reed.

Time and again, the zoo people have left the pandas alone at breeding time (Ling-Ling, the female, comes into estrus once a year), and they have bumbled the job. At least Hsing-Hsing has. Ling-Ling, according to the film, is altogether delightful when in heat. She is affectionate and coquettish and lighthearted, batting her consort in the face and then presenting her own face for him to bat back. But Hsing-Hsing is a real slob—never bringing her flowers or taking her out to dinner. He just wants to sit in the big chair in the evening and watch the wrestling on TV. A lousy lover.

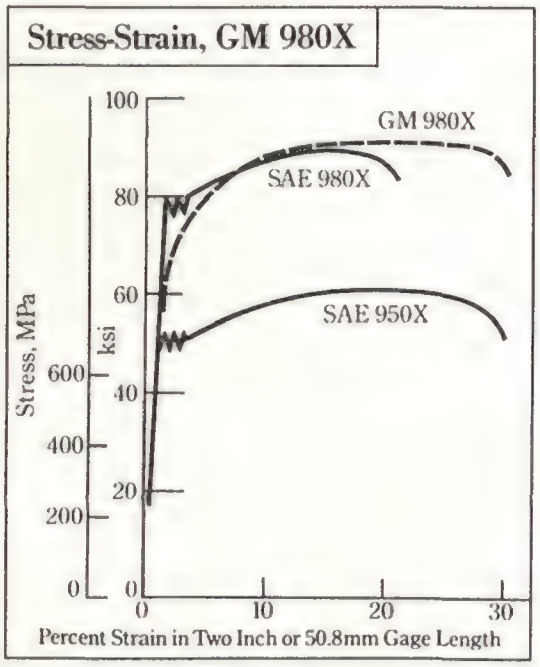
This year the zoo people got into the act, so to speak, trying artificial insemination to make up for Hsing-Hsing's shortcomings. If it works and we produce our first panda cub, I'll try to describe in some detail the very tricky process that the animals were put through. But interestingly enough, we won't know if Ling-Ling is pregnant until the latter part of September. She will show no change until her nipples swell, a mere two weeks before her time is up. Keep your fingers crossed.

—Edwards Park

The Ductility Factor

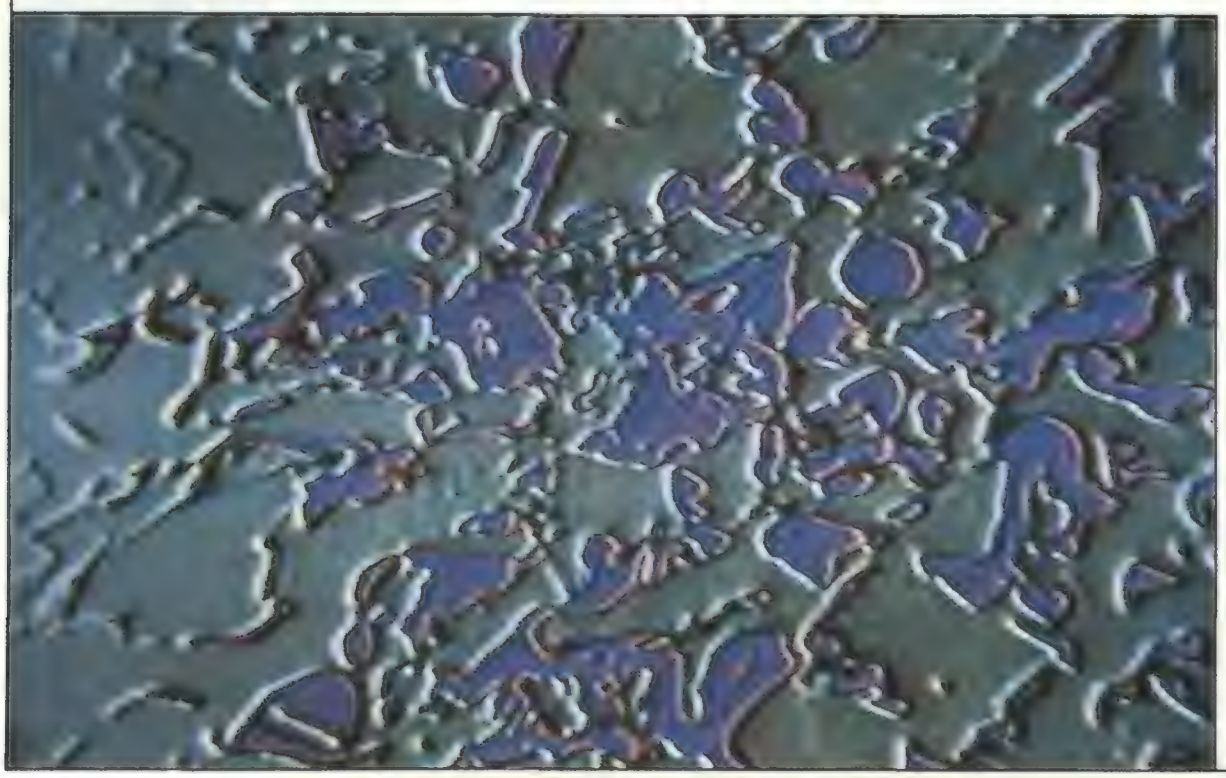
The Ductility Factor

The use of high strength, low alloy steel has been severely limited, due to its low ductility. Now, a simple heat treating and controlled cooling process, developed at the General Motors Research Laboratories, has successfully enhanced formability properties without sacrificing strength.



A comparison of the stress-strain behavior of GM 980X, SAE 980X, and SAE 950X steels. GM 980X offers greater ductility at the same strength as SAE 980X, and greater strength at the same ductility as SAE 950X.

Scanning electron microscope micrograph of dual phase steel at a magnification of 2,000. The matrix (background) is ferrite; the second phase is martensite.



FOR SOME TIME, automotive engineers and designers have been faced with the challenge of building cars light enough to get good gas mileage, but still roomy enough to comfortably transport four or five passengers. One technique which has proved fruitful is materials substitution.

Lighter materials, such as aluminum alloys and plastics and high strength, low alloy steels (HSLA), are being phased into new vehicle designs to replace certain plain carbon steel components. Each, though, has displayed inherent problems which limit its utilization.

Unlike plastics and aluminum, however, HSLA steels have the same density as plain carbon steel. Weight reduction is achieved because thinner sections (less volume) can be used to carry the same load. Since the formability (ductility) of most high strength steels is poor, though, it has only been possible to form simple shapes from it. This has severely limited the widespread use of HSLA steels (such as SAE 980X) for auto components. New hope for the increased utilization of HSLA steel has arisen, however, with the development of a new dual-phase steel, GM 980X, at the General Motors Research Laboratories.

General Motors is not in the steel business, and GM 980X is not a brand of steel. GM 980X is the designation for a type of steel displaying mechanical properties similar to those of the samples first formulated at the General Motors Research Laboratories. "GM" in the designation indicates that the steel is a variation of the conventional SAE 980X grade. In the standard SAE system for material identification, "9" designates that the steel is HSLA. "80" is the nominal yield strength of the metal in thousands of pounds per square inch. The "X" denotes a micro-alloyed steel—one containing on the order of 0.1% of other metals such as vanadium, columbium, titanium, or zirconium as a strengthening agent.

GM 980X displays the same strength, after strain hardening, as SAE 980X steel, but has far more ductility. This characteristic allows it to be formed into various complex shapes which were previously thought to be impossible with HSLA steels. The superior formability of GM 980X has substantially increased the utilization of HSLA steel in the manufacturing of automotive components such as wheel discs and rims, bumper face bars and reinforcements, control arms, and steering coupling reinforcements.

Dr. M.S. Rashid, discoverer of

the technique to make GM 980X steel, comments, "I was working on another project using HSLA steel, when I noticed that if SAE 980X steel is heated above its eutectoid temperature (the temperature at which the crystalline structure of metal is transformed) for a few minutes, and cooled under controlled conditions, the steel developed significantly higher ductility and strain-hardening characteristics, with no reduction in tensile strength."

FURTHER experiments proved that the key variables to make GM 980X are steel chemistry, heating time and temperature, and the rate at which the steel is cooled. Specimens of SAE 980X were heated in a neutral salt bath, then cooled to room temperature with cooling rates ranging from 5° to 14°C/sec. (9° to 26°F/sec.). Dr. Rashid notes, "We found that the maximum total elongation resulted when the cooling rate was 9°C/sec. (16°F), and the lowest total elongation resulted from the highest cooling rate (14°C or 26°F/sec.)."

GM 980X steel has a high strain-hardening coefficient or n value, accompanied by a large total elongation. The n value gives a measure of the ability of the metal to distribute strain. The higher the n value, the more uniform the strain distribution and the greater the resistance of the metal to necking (localized hour-glass-shaped thinning that stretched metals display just prior to breaking). Tests have proved that GM 980X distributes strain more uniformly than SAE 980X, has a greater resistance to necking, and thus has far superior formability.

"The superior formability of GM 980X compared to SAE 980X steel appears to depend on the nature of two microstructural constituents, a ferrite matrix (the principal microstructural component) with a very high strain-hardening coefficient, and a deformable martensite (the other crystalline structure) phase. In the SAE 980X, failure occurs after the ferrite becomes highly strained, but when the GM 980X ferrite is highly strained, strain is apparently transferred to the martensite phase, and it also deforms.

"Therefore, voids leading to failure do not form until after more extensive deformation has occurred and the martensite phase is also highly strained. Obviously, the exact nature of these constituents must be important, and any variations in the nature of these constituents could influence formability. This is the subject of ongoing research."

Dr. Rashid's discovery represents a significant breakthrough in the area of steel development. His findings have opened the door to a new class of materials and have completely disproved the commonly held belief that high strength steel is not a practical material for extensive automotive application. "At GM, we've done what was previously thought to be impossible," says Dr. Rashid, "and now we're hard at work to find an even stronger and more ductile steel to meet the needs of the future."

THE MAN BEHIND THE WORK

M.S. Rashid is a Senior Research Engineer in the Metallurgy Department at the General Motors Research Laboratories. He was born in the city of Vellore in Tamil Nadu (Madras), India, and attended the College of Engineering at the University of Madras—Guindy. He came to the United States in 1963 and was awarded a Ph.D. in Metallurgical Engineering from the University of Illinois at Urbana-Champaign in 1969.

After a three year Post-Doctoral Fellowship at Iowa State University, he joined the staff of the General Motors Research Laboratories.

Dr. Rashid is continuing his investigations into the development of even more ductile high strength, low alloy steels. When not in the lab, he enjoys relaxing by playing tennis and racquetball with his wife, Kulsum.

GM General Motors
People building transportation to serve people

By William Weber Johnson

Modern Mexico was formed in the crucible of revolution

For years the armies of Zapata, Villa, Obregón and Carranza raged through the countryside; finally, a new constitution and la Democrácia baffling country with its many seeming contradictions.

Understanding Mexico was once regarded as a harmless but not particularly useful endeavor. Historically the country had been ignored, preyed upon and exploited by larger, more powerful nations, including the United States. Now it's another matter. Mexico is one of the world's oil-rich nations and so gaining eminence. Oil wealth may provide solutions to such chronic Mexican problems as overpopulation

It was a small hotel in Mexico City, close to the *Caballito* or "Little Horse" as Mexicans derisively call the giant equestrian statue of Carlos IV. It was very clean and cheap enough for a student. It was run by a pleasant Swiss couple, with a friendly porter, a Mexican, who knew all about the hotel and many other things. He was trying to learn English just as I was trying to learn Spanish—by speaking it. Our conversations were incoherent, but earnest and prolonged.

He showed me the room in the hotel once occupied by Alvaro Obregón when he returned to Mexico City in pursuit of Pancho Villa, and the rooms that had once been Venustiano Carranza's suite. The names were only vaguely familiar to me, but I knew that they were somehow connected with the Mexican Revolution. It was an event that was then as fresh in Mexican memory as Vietnam now is in ours, and subject to almost as much debate.

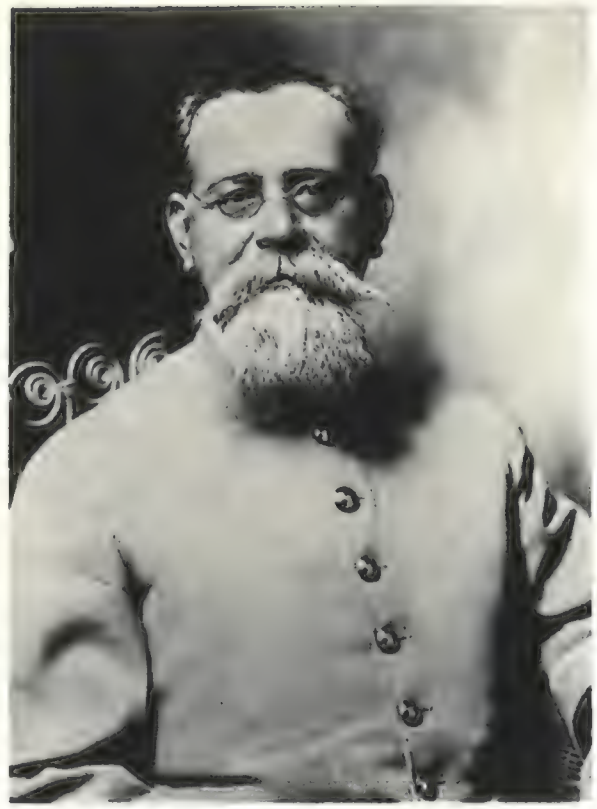
Everywhere I went there was talk of Obregón, Carranza, Villa, Zapata and other Revolutionary leaders, most of them long dead. Why did so many of them, struggling to bring about a better world, end up fighting and killing each other? It puzzled me then, and still puzzled me much later when I worked in Mexico as a journalist, trying to understand that beautiful and

Don Porfirio Díaz glitters with the decorations of his 31-year rule. He was toppled in 1911.

A victorious Pancho Villa rides into Torreón, taken with his fierce striking force of the north, 1913.

Gentle, cultured Francisco Madero was slain after 16 months as president.

Victoriano Huerta plotted Madero's fate, had to flee himself in 1914.



President Venustiano Carranza was elected in 1917, slain in 1920.

(Mexico will pass the 100 million mark before the century's end), poverty and underemployment. The combination of these social ills has in the past resulted in suffering within Mexico and a mass migration of poor, undocumented Mexican workers across the border into the United States.

Everywhere in today's Mexico, however, there is a sense of purposeful hurry. A sleepy village on the Pacific becomes an industrial center and a deep-water port almost overnight. A slow-moving town on the Gulf coast, near the new oil fields, becomes a bustling metropolis filled with men wearing hard hats or carrying briefcases. Mexico is pushing back its economic and social frontiers with the same sort of vigor the United States displayed in the mid-19th century. In both countries explosive growth came as a delayed aftershock to great national upheavals. In the United States the upheaval was the struggle for independence. In Mexico it was the Revolution.

In 1910 Mexico had been theoretically independent for almost a century. But freedom was ineffectual. Power continued to be concentrated in the hands of a landowning oligarchy, the Church and the military. Arable land, always scarce, was controlled by fewer and fewer families and institutions. The war with Texas in 1836 drained the country. Then the United States, driving toward "Manifest Destiny," subjected Mexico to a punishing war in 1846-48 and cut in half its territory. The War of the Reform, 1858-61, tore the country apart. France moved in and set up a satellite monarchy in 1864 under the ill-fated Maximilian.

Not until Porfirio Díaz, a hero of the war with the French, became President in 1876 did Mexico begin to achieve, at great cost, some degree of stability. Díaz arranged his reelection so many times that he was known as the "eternal president." A young and beautiful second wife taught him to dress and comport himself with elegance. He favored big business, was given to tears on emotional occasions and advertised himself throughout the world as the man who had brought modernity to Mexico.

In 1910, Díaz celebrated the centennial of Mexico's struggle for independence. He invited the world's wealthiest and most powerful men to come to Mexico as his guests for the occasion. He stunned them with pageantry and plied them with imported delicacies and wines such as his own people had never tasted. And the old dictator, whose own blood was predominantly Indian, ordered the Indians, an ethnic majority, to stay off the streets lest their poverty offend the visitors. Not too long after this, iron-fisted Díaz was toppled in the early spasms of the Mexican Revolution.

It started under the leadership of a simple, idealistic little man, Francisco I. Madero, with a simple, idealistic little slogan: "Effective suffrage, no reelection." Never again, if the Revolution succeeded, would anyone be able to perpetuate himself in office as Díaz had done. But, simple as Madero's appeal was, it at-

Mr. Johnson wrote on the Tamayo museum in Oaxaca in SMITHSONIAN *in August 1975. He is author of* Heroic Mexico, *a narrative history of the Revolution.*

tracted all kinds of Mexicans who were miserable, oppressed or angry. Some joined the movement barefooted and in rags, armed with nothing more than machetes. Some came well-mounted and well-armed, dressed in imaginative uniforms. There were ranchers, cowboys, field workers, bandits, merchants, professional men and students. Pent-up frustration fueled a mass movement, ragtag but irresistible. Díaz, old, ill and utterly perplexed, fled to Europe.

Madero was, quite legally, elected to the presidency in a huge outpouring of popular support, even though some of his supporters were not clear about just what it was they had achieved. When Madero made his triumphant entry into Mexico City there were cheers of *"Viva Madero! Viva la Democrácia!"* Such was the confusion of aims and understanding that some, it was said, thought *la Democrácia* was the lady sitting at Madero's side in the carriage, his wife Sara Madero.

The idealistic Madero had trouble almost from the outset. A tiny man, barely five feet three inches, he was gentle and thoughtful, with all the social graces that mark the son of a family of wealth and power. Born in Coahuila in northern Mexico, Madero was educated in the United States and France. He was a philanthropist and a practicing spiritualist—an impractical dreamer in the eyes of business and foreign interests. Old-line politicians looked on his honesty with alarm, and much of the military thought him a fool. Betrayal by supposedly loyal army leaders led to Madero's overthrow and imprisonment. Soon after, he and his vice president were assassinated.

Rebels unite, then fly at each other

This was the first of a series of violent turns in the Mexican Revolution. Fellow revolutionaries could unite valiantly against a common enemy. Then, very often, they would turn savagely on each other, like blood-frenzied sharks.

At first there was a mighty alliance against the usurpation of the presidency by the man who had authored Madero's downfall, a bullet-headed old Indian named Victoriano Huerta. Known to his enemies as "The Jackal," he was fond of both cognac and marijuana. A professional soldier, wily and crafty, who tended to profit financially from his military campaigns, Huerta was faithful to Díaz. He had made an outward show of loyalty to Madero while plotting his downfall. And it is still a rancorous memory in Mexico that The Jackal was strongly supported by the U.S. Ambassador, Henry Lane Wilson.

In the south, Emiliano Zapata, a slender ex-rodeo rider with the blue-black hair and luminous dark eyes of an Indian, had from childhood resented encroachments on traditional Indian lands. He inspired his followers to wage a punishing hit-and-run war against Huerta's federal troops. Shouting "Land and Liberty," *Zapatistas* burned haciendas, seized the land—and armed themselves with weapons left behind by fleeing enemies. To his family and followers he was 'Miliano; to his foes, the Attila of the South.

In the northwestern state of Sonora, a witty, resourceful farmer named Alvaro Obregón, with no military background and little prior interest in such matters, emerged as a brilliant field commander and quickly rose to fame in the revolutionary ranks. With fair skin and green eyes reflecting his Spanish descent, Obregón's carriage was military while his dress was a shambles. He had a chess player's foresight and a phenomenal memory, with the authority, dignity and good humor of a born leader.

In Chihuahua, Doroteo Arango, better known under his assumed name, Francisco "Pancho" Villa, a onetime milkman, cattle rustler and butcher who had rallied to Madero's cause, rose again and marshaled

Talented Alvaro Obregón lost arm fighting Villa. President from 1920 to 1924, he was later killed.

"Adelita" was generic name for women of Revolution. Here, one peers from the steps of a military train.

his guerrilla followers into the most awesome striking force of the Revolution. Villa's troops herded stolen cattle across the border into Texas to pay for guns and ammunition, and they were well armed. The flamboyant Villa's moods seemed to swing erratically between sentimentality and towering rage. A sharecropper's son, he had grown up a bandit and an outlaw who delighted in embellishing the tales of exploits which had made him a folk hero, and was so at home on horseback he was known as the Centaur of the North. He was nevertheless a great natural commander, as was Obregón.

And in Coahuila, gray-bearded Venustiano Carranza, conservative landowner-politician whose blue-tinted spectacles concealed whatever expression there might be in his eyes, proclaimed himself First Chief of the Constitutionalist Army, dedicated to returning Mexico to government under the Constitution of 1857. In this role he worked to harness the various revolutionary forces into a manageable whole. Without ever firing a shot himself, he became a dominant figure in the struggle.

Pancho Villa at first acknowledged the leadership of this elderly autocrat, and accepted his orders. But he seldom obeyed them. Zapata paid little attention to Carranza. Obregón, the most consistently successful general of the Revolution, was also the most consistently loyal to Carranza until shortly before the latter's violent death.

On all fronts, with Villa in the north, Obregón in the northwest and Zapata in the south, the intensity of the fighting steadily grew. New and more deadly weapons were introduced, including machine guns. Railroads were converted into instruments of war. Troops traveled in and on top of freight cars. Cabooses became command posts. Locomotives were used not only to pull trains to the front but also to pull up track behind them in retreat. Sometimes a locomotive would be charged with dynamite and sent under full steam to crash head-on into an approaching enemy troop train. Zapata once loaded an engine with his men and slammed it into a hacienda to seize arms.

All civil wars tend to be family affairs, fathers pitted against sons, brothers against brothers. In Mexico whole families went to war. The federal army had long allowed soldiers to bring along wives and girl friends, thus saving the expense of a commissary and medical

Mexican child, draped with cartridge belts, was probably a bearer for her mother or father.

Soldaderas like this one moved into the lines and fought when their men fell in battle.

facilities. The women, called *soldaderas,* could cook, nurse the ill and wounded, share the blankets and generally provide the comforts of home. People said that the practice dated back to Hernan Cortés, the conqueror, and Malinche, the Indian girl who served him as mistress, interpreter and tactical adviser.

All military units, both federal and revolutionary, tended to live off the land. While the men were fighting or caring for their weapons or horses, the *soldaderas* scoured the countryside for chickens, pigs, beef, eggs, beans, chiles, fruit and firewood. *Soldaderas* from one side would trade with those of the other, cartridges for corn, dynamite for blankets. The bullet a *soldadera* traded for a handful of beans might provide her man's supper but might kill him the next day.

Children often marched along with their mothers and eventually would join the ranks if they were large enough to lift and aim a rifle. More children were always arriving, born in the dust and din of battlefields.

When a man fell, a *soldadera* often would don his

Disdaining blindfold, an early revolutionary faces firing squad—a scene repeated many times.

Bullets raise dust in adobe walls; victims pitch forward or slump. This grim mass execution

cartridge belts, seize his rifle and continue the fight herself. They were often considered belligerents and treated as such: on one occasion Villa, overrunning an enemy position, ordered all *soldaderas* shot.

These durable women were celebrated in such sentimental songs of the revolution as *Valentina* and *Adelita*. Adelita came, in time, to be a generic name for all *soldaderas*. In the song her charms were such that the soldier swears he will follow her "if by sea on a warship, if by land on a military train."

With or without the nursing provided by the *soldaderas,* casualties were staggering (in the decade 1910-1920 Mexico had a net population loss of a million). Late in the struggle some revolutionary units had mobile field hospitals, but they were the exception, and inadequate care of the wounded increased the toll.

Most fighting was to the death. If taken at all, prisoners usually were executed. So were people merely suspected of animosity toward this or that revolutionary leader. There came to be a certain etiquette to executions. It was all right to accept a blindfold before the firing squad, but it was considered more estimable to face the rifles with open, unblinking eyes. It was customary for the victim to empty his pockets before taking the final stance, giving his cash to the executioners and perhaps requesting that a ring or a watch be delivered to his wife, sweetheart or mother.

If the man to be shot held the rank of general, he was usually granted the privilege of giving the squad the order to fire. He could, in most circumstances, make a final statement before dying if it did not take too long. It was generally regarded as good form to shout *"Viva México!"* just before the final blast. Coolness was highly regarded. If a man could nonchalantly puff a cigarette or cigar until a split second before the firing squad's volley, he might well have his valor memorialized in song.

The gesture of the final smoke was almost the undoing of Rodolfo Fierro, Villa's *pistolero* or executioner. Fierro was a veteran of hundreds, perhaps thousands, of executions: he once suffered a blister on his trigger finger from executing, one by one, a corral full of prisoners. Villa once ordered Fierro to find and execute his critic, David Berlanga, a young journalist.

Fierro found Berlanga sitting in a café, just lighting a cigar. He ordered him out and marched him to the San Cosme barracks and its much-used execution wall. Berlanga had continued to smoke his cigar and by now it had a long, unbroken ash. Fierro stared in amazement while Berlanga continued to smoke, waiting coolly for the killing volley. His hand was steady and the ash grew longer and longer.

Fierro finally gave the signal and that was the end of Berlanga—but not of Fierro's memory of the event. He began smoking cigars, seeing how long an ash he could hold, but he could never match Berlanga. (The

took place in 1915—in all Mexico's history perhaps the bloodiest year since the Conquest.

executions, as well as scenes from combat, were thoroughly documented, for in this revolution photojournalism came into its own. Major battles were covered by photographers and reporters, and many generals, especially Villa, loved performing for the camera.)

The greatest rivalry of the Revolution was between Obregón and Villa, the two most successful generals. Had it not been for Carranza, the two might have got along. Both were courageous and born leaders. But Carranza distrusted Villa from the very outset and did all he could to circumvent Villa's military successes.

Villa, the onetime cattle rustler, had natural talents as a guerrilla fighter—raw courage, durability and great skill with horses and guns—qualities that also marked Zapata's men in the South. Villa's alliance with General Felipe Angeles, a skilled and principled professional soldier, curbed his natural wildness and added strategic sense to his instinctive tactical skills. Angeles' counsel was of utmost importance in Villa's most stunning victory, at Zacatecas in 1914. The victory was won against Carranza's wishes. The First Chief wanted strategically important victories such as this to go to a more manageable general.

Federal troops, in foreground, exchange volleys with straw-hatted *Zapatistas* on hillside.

At about the same time Obregón, who had advanced steadily down the west coast, won an important victory at Guadalajara. These two revolutionary successes, Villa's at Zacatecas and Obregón's at Guadalajara, broke the back of Huerta's federal forces and Huerta, like Díaz before him, fled into exile.

The revolutionary forces occupied Mexico City, and the haughty Carranza called a conference of selected revolutionary generals (Villa and Zapata were excluded) and civilian supporters to decide where they went from there. Carranza did not want to relinquish power, but neither did he want to serve as interim president since this would, by law, exclude him from a regular term as president.

The conference met in Mexico City and paid its respects to Carranza. It then adjourned and the generals reassembled in Aguascalientes, where all revolutionary factions could be represented and plot a new course, free of Carranza's domination. This time Villa and Zapata were represented. The result of many stormy meetings was the formation of the so-called Convention government. It called for Carranza's resignation. Villa became the military arm of the Convention. Carranza fled and set up his government in the port city of Veracruz. Here he was joined by Obregón, who began the task of rebuilding an army.

Mexico City was occupied by Villa's and Zapata's troops. Villa's were noisy, rough and greedy; they occupied the city's greatest mansions and ate at the finest restaurants without paying. Zapata's men by contrast were quiet, even shy: they occupied modest quarters and paid for whatever they took or ate with silver money they had coined themselves. Villa and Zapata

Early in the Revolution a federal soldier waits with his family for a train. Mexican practice was for wives, sweethearts and children to join the troops, cooking and caring for them.

became personally acquainted, discovered they shared many social ideals and had their picture taken together, Villa sitting in the presidential chair (p. 40).

The Convention government disintegrated. At one point there were four Mexican governments situated in different parts of the country. Villa had returned to the north. Obregón, after only token opposition from Zapata at Puebla, returned to Mexico City. The capital was a disaster area, short of food, water, fuel and medicine. Nevertheless, Obregón was able to use it as a staging area for his advance toward the north.

Villa vs. Obregón: a bloody duel

The battles between Obregón and Villa, when they came, were perhaps the bloodiest of the Revolution. Villa's famous Division of the North was crippled. Obregón lost his right arm to an artillery shell. Villa went on to further defeats and disappointments, the greatest of which was de facto recognition of Carranza's government by the United States. This was a bitter blow to Villa, who had, until then, tried to maintain friendly relations with the United States.

In a fury Villa reverted to his outlaw ways. Early in 1916 the *Villistas* raided the border town of Columbus, New Mexico, burning business buildings, attacking the camp of the 13th U.S. Cavalry and riding away with horses, mules and a quantity of weapons. It was a seemingly senseless operation in which about 100 *Villistas* and 18 Americans died.

The United States then launched the so-called Punitive Expedition, led by General John J. "Black Jack" Pershing. The Americans failed to catch Villa, and about the only result was to get Pershing and his men some field experience prior to American entry into World War I.

Encouraged by diplomatic recognition and emboldened by Villa's decline, Carranza finally returned to Mexico City. He called for a constituent convention to draft a new Constitution and early in 1917 was elected to the presidency. Carranza himself was honest, but he organized an administration notorious for its corruption. It soon aroused the distrust of many of his erstwhile allies, including the faithful Obregón. Zapata continued to embarrass Carranza with guerrilla operations in close proximity to the capital.

Zapata was finally trapped in a Byzantine piece of trickery. One of Carranza's federal officers hinted to a prisoner of *Zapatista* sympathies that he might be willing to switch sides. Word of this reached Zapata, just as it had been intended to do, and Zapata was interested. The federal officer then, to establish his credentials as a turncoat, launched an attack on federal troops and killed many of them.

Zapata was convinced and a meeting was arranged.

Dogs also did their bit. These two are harnessed to a cart for the Federal Army's signal corps.

Rurales, the vicious, dreaded federal police, gather at railroad siding to load their horses onto a train.

When Zapata arrived at the rendezvous, he was gunned down in cold blood. The supposed turncoat was rewarded by Carranza, but the cynical ruthlessness of the operation was politically damaging.

Carranza chose as his successor in the presidency a relative unknown. Obregón declared his candidacy and began to campaign, but finally had to flee.

Sonora, Obregón's home state, repudiated Carranza and 14 other states did likewise. Carranza, left with almost no support, once again deserted Mexico City, taking the national treasury with him. Deep in the mountains of Puebla he was forced to abandon his train and flee into the high sierra. In the early morning of May 21, 1920, his party was attacked in a deserted Indian village and Carranza was killed. Alvaro Obregón was legally elected to the presidency. The worst of the fighting was over.

The most significant monument to Carranza is the Constitution of 1917, a document that laid the foundation of today's Mexico. Its most controversial provisions pertained to the nationalization of church properties, divorcement of religion from the schools, the rights of labor, the government's right to expropriate land or other resources and redistribute them and, most particularly, the declaration that all subsoil resources belonged to the nation and could be exploited only through concessions by the nation.

Mexico had been producing great quantities of oil since 1910. However, there were increasingly severe labor disputes and to end them, in 1938, President Lázaro Cárdenas nationalized the oil industry, using the 1917 declaration regarding subsoil resources as justification. As a result, Mexico does not have to share its oil wealth with anyone.

It has been almost a half-century since the porter at the old St. Francis showed me the rooms once occupied by Carranza and Obregón. The hotel has disappeared and so has much else which was once agreeable. Mexico City has become a supermetropolis, one of the world's largest. It is a place of hideous traffic, choking smog, dying trees, unsavory smells and headsplitting noise, all signs of a city and nation growing at an exponential rate.

The "no reelection" that Francisco Madero fought and died for has become fact. It has produced an unorthodox form of democracy in which each president, late in his six-year term, personally chooses his successor, a choice that is then ritualistically ratified by election. Instead of the clones that might be expected from such a system, there has been a remarkably disparate succession of presidents—a radical idealist, a staunch Catholic (in an officially anticlerical government), a wheeler-dealer, a fiscal conservative, a big spender, and so on.

The incumbent, José López Portillo, is a well-educated, practical politician and a tough negotiator. On taking office he had to pull the nation back from the brink of bankruptcy, and he is trying to manage a newfound oil bonanza in a way to ease Mexico's chronic problems.

He is also the author of a semipoetic fantasy about Quetzalcoatl, the plumed serpent, a pre-Hispanic Mexican god. Unlike most deities in the pre-Hispanic pantheon, Quetzalcoatl was a benign god of enlightenment who opposed human sacrifice. How he would have felt about the Mexican Revolution has not been ascertained.

Villa, in presidential chair with Zapata on his left, exults after triumphal march into Mexico City, 1914.

Emiliano Zapata, dressed to the nines, poses here with weapons. Usually he wore peasant garb. Fearless and resourceful, he was an idealist who would seize a hacienda, then turn it over to the peasants.

By Edward Lucie-Smith

'Mr. Five Percent' amassed power along with beauty

Shrewd and paradoxical, Calouste Gulbenkian was a money master and art lover who left his fortune and a great collection to the public

Gulbenkian memorialized at Lisbon Foundation in statue modeled on a snapshot taken in Egypt.

French furniture includes, above, pair of Regency medal cabinets, Regency commode and table, Louis

In his own lifetime, Calouste Gulbenkian was both notorious and unknown. The object of unceasing public curiosity, he managed to give very little of himself away. Today, though more is on record, he remains mysterious—an Arabian Nights Oriental who conquered the Western world of business. He is remembered as the builder of one of the world's greatest art collections, now housed in Lisbon in the special museum shown on these pages.

He was also the founder of a huge charitable foundation. According to Lord Vaizey, a well-known British economist who has long been one of the Foundation's advisers, it is the largest outside the United States, although "smaller than Rockefeller and Ford."

XVI bergère. Porcelain is Qing. Tapestry
is Beauvais after a cartoon by François Boucher.

Set up shortly before he died, it is devoted to four main endeavors: welfare, art, education and science. About 60 percent of its annual expenditure has been allocated to Portugal itself, with most of the remainder being disbursed to widely varied projects and activities in the Middle East, the Armenian diaspora and Great Britain.

Would Gulbenkian, a quintessential conservative and capitalist, have disapproved of the social uses now being made of his money? His son Nubar thought he would have, and fought a complicated legal battle to prove it. Such eminent Englishmen and friends of the elder Gulbenkian as Lord Clark, the art historian, and Lord Radcliffe, a brilliant lawyer, for many years an adviser to Calouste and the man he had wished to head his foundation, agreed with Nubar. Yet Gulbenkian was paradoxical in everything, perhaps even in this, and his will was not explicit. The Foundation has moved with the times, and that after all was always a secret of his own success.

Where did his money originally come from? Calouste Gulbenkian was the son of a nouveau riche Armenian family, born in Kadiköy on the Asiatic shore of the Bosporus opposite Istanbul. His father Sarkis had dealt in carpets, but by the time his son was born he was a wealthy petroleum importer and banker. As a young man, Calouste tried his hand at the rug trade too, and had one of his few catastrophic

Photographs by Dmitri Kessel

failures. His good fortune was to spot the possibilities in oil somewhat before the world had been conquered by the internal combustion engine. He exploited his insight with a rug-peddler's instinct. Just before the 1914-18 war, and without ever going to Iraq, he succeeded in negotiating for himself a five-percent share in the recently discovered Iraqi oil-fields. After the war, when it looked as if his deal was in ruins, he renegotiated it, and actually strengthened his position. In 1920 the San Remo Oil Convention assured him of his old percentage, and gave it to him completely in his own right, as if he were a sovereign state like the other signatories, and not an individual. Consequently, Gulbenkian became known universally as "Mr. Five Percent."

For the rest of a long life, he defended his business interests with unrivaled finesse and pertinacity. When he died in 1955, his percentage was bringing in $14 million a year. Today the Foundation, working with almost equal foresight and subtlety, has diversified out of oil. Its gross income is undoubtedly much larger than anything its founder enjoyed for himself. Gulbenkian would have been delighted. He wanted to see the fortune he had created enjoying an independent life of its own, almost no matter what the money was used for. The chief beneficiaries are Great Britain and Portugal, Portugal most of all. Indeed, the latter could scarcely do without the Foundation's resources which, in Lord Vaizey's words, "have been used to build the whole infrastructure of a modern state, when the state itself wasn't prepared to do so." It seems characteristic of the Gulbenkian heritage that the Foundation, under its present head, Mr. Five Percent's longtime, trusted Lisbon lawyer, Dr. José de Azeredo Perdigão, should so easily have come to terms with the recent Portuguese revolution.

In one sense the Gulbenkian art collection is simply another manifestation of Calouste's gift for acquisition through negotiation. His son Nubar once said: "Negotiating was his hobby. He enjoyed it, not primarily for the rewards, which he valued as a token of success, but from the thrill he got from the battle of wits with the biggest and best financial brains in the world and the satisfaction of forcing other great conflicting interests to compromise."

His greatest coups—not one but a whole series—as a collector-negotiator were undoubtedly the purchases he made from the Soviet government in 1928-30. The Russians were desperately hard-pressed for foreign currency, and the situation might have been created specially for Gulbenkian's gifts. The Bolshevik hard men turned out to be no match for him.

On the surface, he was extremely fair. He warned the vendors that what they were doing was bad for their prestige. "Sell anything you want," he wrote, "which is not out of museums, but to touch the national patrimony will only arouse serious suspicions." When accused of having bought what he wanted ridiculously cheap, he replied that he was quite ready to sell back all the objects he had bought for the price he had paid plus 6% interest. He knew perfectly well that the offer would never be taken up.

The truth was that he did get some astonishing

Rubens' *Portrait of Helena Fourment,* a bargain buy from the Hermitage, once belonged to Catherine II.

Gulbenkian bought Rembrandt's superb *Figure of an Old Man* from Soviets during their financial squeeze.

Festival of the Ascension in the Piazza di San Marco, opposite, is one of 19 Guardis in the collection.

Louis XV desk by 18th-century artisan Jacques Dubois is beneath 1752 portrait by Nattier. At left,

bargains. For example, one purchase, a kind of bulk deal, consisted of 15 great pieces of French 18th-century gold and silver, plus Rubens' marvelous portrait of his second wife, Helena Fourment. Gulbenkian began by offering $727,000 for the gold and silver alone. When the Russians stalled, he insolently *reduced* his price instead of raising it. This so unsettled his opponents that he succeeded in buying the 15 pieces of silver, *plus* the Rubens, for a mere $752,000!

One of Gulbenkian's advantages was that he instinctively understood the Soviet government's need to save face when selling treasures from the Hermitage. The flamboyant art dealer Duveen was prepared to pay $750,000 for Houdon's statue of *Diana*. Gulbenkian negotiated quietly and got it for $30,000.

On one occasion he managed to buy a major tapestry from the Kunsthistorisches Museum in Vienna which, having many fine tapestries, needed the money to keep a rare chalice from leaving the country but wished to avoid publicity. Once more his combination of skill in negotiation and absolute discretion brought him a success no one else could have achieved.

Yet Gulbenkian wasn't merely a financial wizard, exercising his gifts in a congenial field. He truly loved art, and he loved it all his life. Writing to the great expert on Iranian art Arthur Upham Pope, he cited what Pope later termed "the old Persian notion" that great art "makes you feel young and strong and glad." He claimed that he had first begun to collect when he was still a boy in Istanbul, long before his thoughts turned toward the oil industry. When his father gave him 50 Turkish piasters as a reward for success at school, he immediately hurried off to the bazaars and bought some old coins. When he was only 20, he published a travel book in good if rather involved French, expanded from a series of articles which appeared in the prestigious *Revue des Deux Mondes*. It contained a special chapter on Oriental carpets. There are splendid coins and equally splendid carpets in the Gulbenkian collection today. Indeed, his collecting instinct was so strong that Gulbenkian himself sometimes feared it as a threat to other sides of his complex nature. Soon after the Second World War he was offered a famous painting by Constable at what seemed to him a high price. "I will not buy it, although I like it," he replied. "I must control myself, otherwise I would consider that I was going to pieces."

Perhaps the best way of approaching the Gulbenkian Collection is not, however, the obvious one—through Gulbenkian's attitudes to business and to money—but through something far more fascinating and mysterious: his attitudes as an Oriental making a life for himself in the Western world.

Like many cultivated Orientals, Gulbenkian had a passion for nature and natural marvels which rivaled his passion for art. One evening the yacht he had hired for a brief cruise came to anchor off Kotor on the coast of Yugoslavia. "I spent two exquisite hours on deck,"

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Louis XV commode with Qing Dynasty pitcher.
Beside it is 18th-century French Louis XVI armchair.

he recorded in his diary, "listening to the nightingales. It is a unique and unexpected song: one could hear them on every side." Whenever he could, Gulbenkian worked in the open air, at some charming but secluded spot. He even went so far as to create a ravishing 84-acre landscape garden, but one with no residence befitting him, near Deauville, where he went for a few weeks in the summer every year. He would stay at a hotel, and drive up to spend part of every day at Les Enclos. "What I want above all," he wrote to his landscape gardener, "is that the park should have a romantic character . . . the natural beauty of the trees will be an immense help in fulfilling my idea. . . . My great desire is to achieve a harmonious whole . . . no pretentiousness, no artificialities, no finicky details."

He collected orchids and rare birds in much the same way as he collected works of art. His orchids (the source of his son Nubar's famous orchid boutonnieres) were boarded out with an orchid grower at Haywards Heath, near London, just as Gulbenkian often used to leave art objects for many years at the dealers from whom he bought them, sometimes going to visit them in secret. The rare birds were kept in cages on one of the terraces of his sumptuous house on the Avenue

Special room is reserved for works of René Lalique.
Here, a brooch of silver, crystal and baroque pearl.

Fantastic dragonfly corsage ornament, topped by female bust, is made of gold, enamel and chrysoprase.

Small sculpted objet d'art typifies Art Nouveau.
A paperweight, it is of ivory, bronze and pearls.

Calouste Gulbenkian and his collection

Jean-Antoine Houdon's marble *Diana,* 1780, belonged to Catherine the Great, was bought from Hermitage.

d'Iéna in Paris. When France fell in 1940, Gulbenkian fled to Vichy, and his Paris office heard nothing from him for two weeks. When a message finally arrived, all it said was: "Don't forget to feed the birds."

Gulbenkian also managed to combine sex with the urge to collect. One of his biographers tells us that "he maintained a carefully selected and changing harem. Only the best satisfied his collector's instinct. He was not a hoarder. One exquisite acquisition was frequently being replaced by something better. The discards were 'disposed of' as if they were comparatively inferior objets d'art." Gulbenkian would not have been taken aback by the comparison. On refusing a scholar access to his art collection when it was kept in Paris, he said, "Would I admit a stranger to my harem?"

In fact, the more closely one examines it, the more the Gulbenkian Collection can be seen as an extremely elaborate self-portrait. His son-in-law, Kvork Essayan, caught one aspect of it when he wrote that "his most constant preference indeed seems to have been for paintings or sculptures where the bodies of women, both clothed and unclothed, graceful or voluptuous, pay a loving and deeply felt homage to the great masters of the past, to the visionaries who immortalised their models—however humble they may have been—and raised them to the ranks of the goddesses." Despite the presence of two Rembrandts, and the MacGregor obsidian portrait head of a Middle Kingdom Egyptian pharaoh, it is not a collection in which one detects any great spirituality. Gulbenkian was apparently indifferent to the purely ascetic and the monastic—a Zurbarán in this context is almost unthinkable—and he never bought anything for the formal artistic values it enshrined.

An eye for the exotic

He did, on the other hand, have a most delicate sense of how works of art play upon our senses. One sees this in the strange, magnificent Art Nouveau jewels he bought from René Lalique (almost the only contemporary works of art he did buy, apart from a few bronzes by Rodin, a sculptor who was an old satyr himself). It can also be found in the wonderful Turkish Isnik pottery, with its formalized flowers, and in the sumptuous Oriental textiles. The Oriental rooms of the Gulbenkian Collection can justly and accurately be described in a phrase Gulbenkian himself once used of the Alhambra—"an unimaginable dream of harmony and luxury."

He never pursued works of art simply because they were scarce or uncommon. Writing to one of his numismatic advisers about his array of Greek coins, he said: ". . . I want to confine myself to such specimens

A small, exquisite Persian silk panel, in the Isfahan style, is from the Shah Abbas period, 17th century.

French silver collection is outstanding. This 18th-century centerpiece bears arms of the Duke of Orleans.

as are of the finest preservation and most remarkable beauty. I do not want rarities if they are not splendidly preserved and artistic." He insisted that everything must be the very best of its type, and in the best possible state: "I cannot stress sufficiently," he wrote to another agent, "that I am not at all keen to purchase pictures, celebrated as they may be, when they present too many repaints or have been damaged." When he could not get exactly what he wanted, he would not accept an approximation or substitute. He longed for many years to possess Goya's most striking female portrait, the pearly *Countess of Chinchón*. When he was at last convinced he couldn't get it, he decided to do without a Goya altogether.

On the other hand, it clearly meant something to him that so many of his works of art had been owned by famous people in the past. This seems particularly to have influenced his choice in the French decorative arts. He thrilled to the fact that his desk had belonged to Marie Antoinette, and a pair of mustard pots (made as cupids pushing wheelbarrows) to Mme. de Pompadour. The parvenu world he knew as a youth in Istanbul worshipped the more conventional varieties of French culture, and it pleased Gulbenkian to put himself on a level with those who inhabited Versailles in the 18th century. But this was, nevertheless, like all his collecting activity, done purely for his own satisfaction, not to impress others.

Indeed, during his lifetime, it was often remarkably difficult to see what he owned at all. If he thought of his collection as his "harem," he also thought of it as a kind of family, perhaps more satisfactory than his real son and daughter. He constantly referred to his paintings as "my children," and equally often said "my children must not be disturbed; [they] must have privacy . . . they must be happy. . . ." When he lived in Paris, between the two great wars, he would spend hours alone in the Avenue d'Iéna house, communing with his masterpieces.

It is true, of course, that in 1934 he lent 24 of his best pictures, later increased to 31, to the National Gallery in London. But it is instructive to read how his son, Nubar, interpreted his father's thinking to the director, Kenneth, later Lord, Clark: "I have only let the 'children' out of my sight for a few years. The mob can have its stare at them. Afterwards nobody can say I haven't given the public its chance. Then my children can return home and live in peace." Later still, paintings and other objects were sent on long-term loan to the National Gallery in Washington.

How is it, then, that Gulbenkian came to leave so magnificent a legacy to the public he so obviously despised? It was not for reasons of conscience. The making of the collection brought into play all of Gulbenkian's most fundamental characteristics. Not merely an unexpectedly exquisite sensibility, but extreme wariness and determination to exert control over any and every situation. Lord Clark says: "He . . . went to the most incredible lengths to see he wasn't cheated. He was a man of the most violent suspicions.

Check, check, check was his rule in life." He took every precaution which was available to him. He read systematically about art, and took notes on works of art which are still preserved among his papers. He traveled to study other collections. He built up an excellent art reference library. If he could, he conducted his buying in secret, often using humble, nondescript agents whom he set to watch one another (he liked to possess people, body and soul, just as much as he liked to possess fine things). And before any work of art was actually purchased, he would, if possible, keep it at home for weeks, meanwhile canvassing as many opinions as possible—those of the experts who advised him, those of members of his family, the reactions of his secretaries, and even those of his old Italian butler.

The final purpose of all this activity was not to win golden opinions from posterity. Gulbenkian lived for the moment—he was the eternal competitor, trying to vanquish both real and imaginary rivals, and at the same time to satisfy his own self-esteem. Despite the generous support he offered throughout his life to the Armenian church (he built the Armenian church in London) it is extremely doubtful he believed in God.

But, just because he was a materialist, he wanted to go on living in tangible, material fashion. Keeping his collection together was one very obvious way of achieving this aim. At one time the National Gallery in London had high hopes of inheriting Gulbenkian's treasures. Then it was the turn of the National Gallery in Washington. But Gulbenkian resisted the idea of submerging his personality in that of some long-established institution. He wanted to reign alone. During his final years in Portugal he no longer needed even to see the great works of art he possessed. He lived in the Hotel Aviz in Lisbon, driving out nearly every day with his secretary to work at some beautiful and secluded spot—at Cascais, Cintra or Estoril. The bulk of the collection remained in Paris. It was enough to know it was there, and still belonged to him. Occasionally, he gave some indication of his ultimate intention. Between 1950 and 1952, for instance, he presented what Lord Radcliffe described as "a munificent bequest" of paintings, sculpture, faïence and furniture to the Museum of Ancient Art in Lisbon.

When he died, frantic efforts were made by French museum officials to keep the French works of art among the Gulbenkian treasures in France. The 18th-century silver, for example, quite outshone anything in the French national collections. Although Gulbenkian had let it be known that he wished French museums to have the French objects in his collection, Dr. Perdigão succeeded in transferring all of Gulbenkian's masterpieces to Lisbon.

They can be seen now in the modern building the Foundation has created to house them—tranquil, aristocratic, perfect of their sort. Also in the Gulbenkian Foundation complex, gracefully landscaped, and surrounded with beautifully designed and kept gardens in a former park in central Lisbon, are a concert and lecture hall and a central administration building of imposing size and activity—the center of its multinational operations.

Brought together here is an accumulation which rivals the Frick Collection in New York and the Wallace Collection in London. Indeed, in a negative sense, it is a better collection than either, since there are fewer identifiable mistakes. If by any chance something of Gulbenkian lives on in another sphere, one can imagine his sardonic pleasure in the way things have turned out. By leaving his treasures to the public, he ensured that they would go on being his.

Surrounded by gardens and sweeping lawns, Foundation museum is at right, auditorium at left.

A pair of rare *famille rose* Qing Dynasty porcelain jars, with lion finials on lids; they are 51 inches high.

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Romantics

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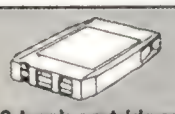

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Before major eruption a geologist observes St. Helens from five miles away. On May 18 another geologist, monitoring volcano from about the same spot, radioed urgently: "This is it!" He was among the missing.

By P.F. Kluge

Awesome message of Mt. St. Helens' mammoth eruption

The peak's cataclysmic explosion serves notice that the Cascades are geologically active, and that Man must plan *to live with volcanoes*

At height of eruption ash clouds boil from summit. Explosion blew out big crater and part of north flank.

Two of the nation's greatest experts on the Pacific Northwest's Cascade Range volcanoes, their histories and the hazards they present, are Donal R. Mullineaux and Dwight "Rocky" Crandell, geologists with the Department of Interior's Geological Survey field offices in Denver. Both are lean, with some gray hair, and in their 50s. Yet until Mt. St. Helens in southwestern Washington State began shaking and pouring out dense clouds of steam, gas and ash this past spring, they had never seen an eruption of one of "their" mountains in all their lives. For there had been no eruption among the dozen-odd major Cascade volcanoes since Lassen Peak, in northern California, thundered to life at the time of World War I, years before they were born.

When local earthquakes began to shake Mt. St. Helens in March, Mullineaux and Crandell hastily dropped what they were doing (preparing to remeasure ashfalls from Mt. Mazama, which exploded some 7,000 years ago and collapsed to form Crater Lake in Oregon), and headed north. St. Helens, 45 miles northeast of Portland, was home ground to Mullineaux, who was reared in the town of Camas, Washington, within sight of the volcano. Early in 1975 he and Crandell predicted that this "prominent but relatively little known" volcano would be heard from again (the last eruption was in 1857), perhaps before the end of the century, and in late 1978 they coauthored a major Survey study documenting the range of potential hazards that could be expected from future eruptions. They described St. Helens as "probably the volcano most likely to endanger people and property in the western United States."

The potential dangers of the somnolent Cascade volcanoes had preoccupied Mullineaux and Crandell for years. Although most were in sparsely populated areas, safely distant from the Northwest's major cities, the scientists were concerned about increasing recreational development of the volcanoes' slopes, and about the sitings of such installations as dams and nuclear power plants. Thus they prowled the mountains, painstakingly collecting data, and back in their Denver headquarters they wrote reports and prepared maps that showed such things as where mud or lava might flow, or where thick deposits of ash might fall.

If Mullineaux and Crandell were not all that surprised when the activity on St. Helens began, most Americans presumably were. We tend to associate volcanic activity with parts of Asia, the Caribbean, Italy, the Hawaiian Islands. We remember Krakatau, Mont Pelée, Vesuvius and Mauna Loa. St. Helens' violent eruption has served as a reminder that the northwestern United States has been the scene of a long series of earthly cataclysms that began millions of years ago. If these do not come vividly to mind, it is simply because most of them took place long before men were

P.F. Kluge wrote about the U.S. Geological Survey in the March 1979 issue of SMITHSONIAN. *His novel,* Eddie and the Cruisers, *will be published this fall.*

Diagram shows major Cascade volcanoes and a cross section through St. Helens. As Juan de Fuca plate descends beneath the North American plate, the rock melts and feeds molten magma up into St. Helens.

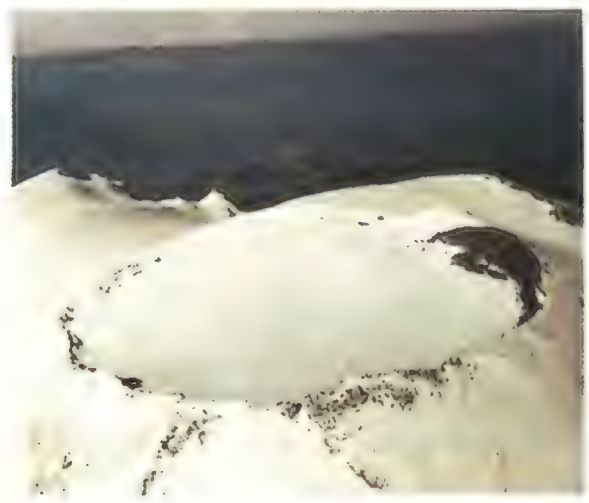
Looking north in Cascade volcano country, nearest peak is Mt. Jefferson, with Hood, Adams and St. Helens

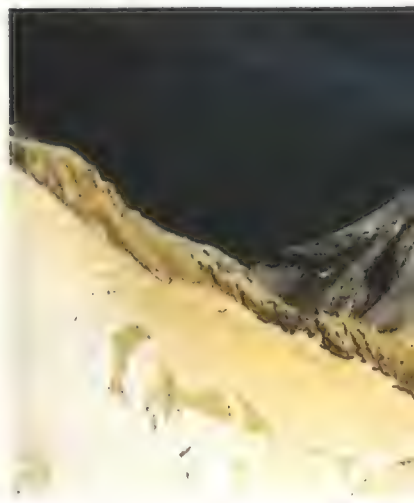
around to be frightened by them—and volcanologists know that we have by no means seen the last of them.

St. Helens is only one of a chain of big volcanoes in the Cascades, stretching nearly 700 miles from Lassen Peak in northern California to Mt. Garibaldi in southern British Columbia. Lying about 45 miles apart on a north-south line, they form a part of the Pacific "Ring of Fire" that arcs from South America to Alaska, Japan and Indonesia, and includes approximately three-fourths of the world's 1,300 active volcanoes.

It was no accident of geography or geology that

Aspects of five Cascade volcanoes are shown below. From left: the youthful summit crater of Mt. Rainier;





on horizon beyond. Geologists believe that all could eventually erupt again, but they cannot predict when.

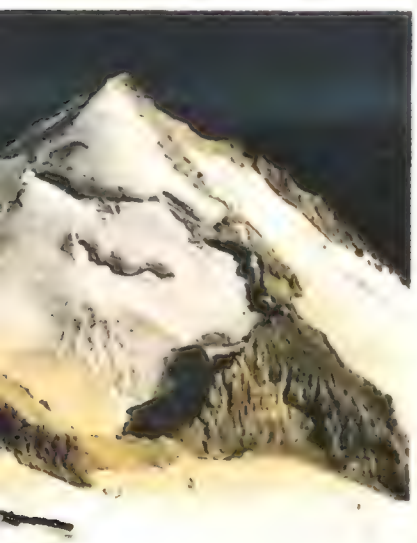
placed the Cascade volcanoes in stately, single-file rank a hundred miles inland from the Pacific coast. Rather, it apparently was the implacable movement—true, only at about the rate a human fingernail grows, but continuing through countless millennia—of the continental and oceanic plates floating on the Earth's mantle. The recently developed theory of plate tectonics helps explain earthquakes, mountain building and volcanoes the world over. In the Pacific Northwest, the Juan de Fuca plate, which underlies the Pacific just offshore, is believed to be descending beneath the edge of the North American plate (left), perhaps at the rate of three inches per year, in a process that geologists call subduction. As the descending plate reaches regions of higher pressure and temperature, partial melting of deep-lying rock takes place. The melt, because of its relatively low density and resulting buoyance, works its way upward to the surface, giving rise to the volcanoes we see.

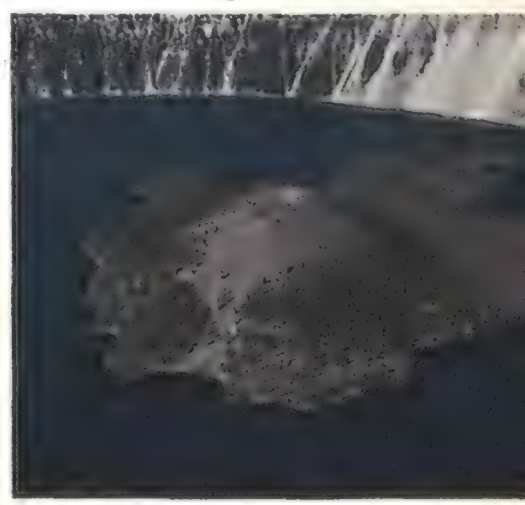
Today's Cascade Range, and much of Oregon and Washington to the east, have been the site of widespread volcanic activity for about 50 million years. Countless volcanoes spewed and sputtered, tossing out lava, lightweight pumice and ash that, with time and weathering, helped to form fertile soil. The most spectacular outpourings took place about 15 million years ago when fluid basalt poured forth, moving at perhaps 30 miles an hour and flooding much of central Washington and Oregon. Individual flows formed gigantic lava lakes, some more than 100 miles across and 100 feet deep (the total accumulated thickness of these flows exceeds 4,000 feet in some places). The Columbia River Plateau, 100,000 square miles filled with 35,000 cubic miles of basaltic lava, is part of what was left.

About seven million years ago the Cascade Range began to be uplifted, forming the rugged platform on which today's volcanoes grew. But they are only the most obvious reminders. Throughout most of the Cascades are seemingly dead cinder cones, or minimountains made of lava cinders, "black glass" mountains made of obsidian, spatter cones formed by liquid blobs around a lava vent, and ice caves.

St. Helens itself, named for an 18th-century baron in the Irish peerage, is a remarkably young volcano, born almost "yesterday" in geologic terms; most of the snow-covered cone was built only within the past 500 years. Until the mountain exploded in May, lowering its picturesque crest by 1,300 feet and leaving a huge, dark, horseshoe-shaped crater in its place, St. Helens

a sulfur-stained shoulder on Mt. Baker; lava that has been "frozen" for 2,000 years at Davis Lake, Oregon; part of a volcanic dike on Mt. Shasta; the Wizard Island cinder cone in middle of Crater Lake, Oregon.





Key geologists on scene are Dwight Crandell, left, and Donal Mullineaux, of U.S. Geological Survey.

was the most symmetrical of the Cascade volcanoes, and was called the "Mt. Fuji of America" for its snowy, uneroded beauty. It has also been potentially very dangerous. It has seldom gone (on an average) more than 100 to 150 years between eruptions, and the Mullineaux-Crandell report called it the most active and explosive volcano in the conterminous United States during the past 4,500 years.

Thanks to carbon dating and careful field studies by Survey scientists since the mid-1960s, the recent eruptive history of St. Helens was better known than that of any volcano in the Cascades. "Hazards documented and mapped," wrote Mullineaux and Crandell in their report, "include flows of lava, mud, or pyroclastic material (hot, dry rock fragments); tephra (airborne rock debris); and floods triggered by eruptions."

The mountain's last eruptive period ended in 1857. One eruption was witnessed and painted by Canadian artist Paul Kane (p. 60), romantically (with a canoe-load of Indians admiring it at night from Spirit Lake) but faithfully.

In March the mountain started living up to its reputation. After a week of shuddery, intermittent earthquaking, it emitted a loud noise just after noon on March 27 and began to eject steam, gas and ash. By dawn, the newly erupted ash was staining its snow-white flanks, a steam plume billowed 10,000 feet above its 9,677-foot summit, two new craters were forming, and flashes of lightning were forking about in the turbulent clouds of ash.

Earth scientists, eager to see and study the volcano, converged on the scene from all over the United States. Some people living or working near the mountain were evacuated, and a reservoir was lowered to make room for any eruption-caused mudflow or runoff.

For weeks thereafter the mountain emitted gas, steam, ash, ice and rock debris at irregular intervals, and occasionally shook with "harmonic tremor," a type of seismic activity that suggested that molten material was beginning to force its way up from below. In April scientists discovered that a one-and-a-half-square-mile area high on the north slope had begun to bulge ominously.

Mullineaux, Crandell and many other scientists worked at trying to predict what was going to happen. They installed seismographs to detect earthquakes and tilt-measuring devices—from store-bought yardsticks to sophisticated instruments—to calculate changes in ground slope. They monitored gravity and magnetic changes, stream flow, and analyzed the chemical composition of the ash and gas collected by aircraft flying through the murky clouds. Thermal tests were made on the ground, and infrared aerial imagery sought out "hot spots" on the mountain.

While all this research helped in understanding the volcano and in supplying baseline data, it provided no advance warning of what was to happen early on May 18 when, with a bang heard 200 to 300 miles away, the mountaintop simply exploded, sending ash and debris some 12 miles into the air.

The eruption, the equivalent of as much as 50 megatons of TNT, ejected some two cubic kilometers of ash and rock, twice that which buried Pompeii. A hypervelocity northward blast of volcanic gases and tephra, preceded by a big avalanche and debris flow and followed by gigantic mudflows and attendant floods, caused widespread devastation, killing people several miles away, destroying wildlife and flattening tens of thousands of acres of forest (p. 61).

The explosion left the Portland ship channel, 45 miles away, blocked with mud that had flowed downstream; blanketed large areas of Washington, Oregon, Idaho and Montana with ash; and sent a high-altitude cloud of debris circling the Earth.

The suddenness and violence of the eruption took scientists by surprise. They had expected the north flank of the mountain, site of the unstable bulge, ultimately to fail, but not without some prior indication that it was about to do so. "Something like this has never occurred in the entire history of the volcano," Crandell said. It occurred, said Robert L. Christiansen of the Geological Survey, "essentially without notice." While most eruptions start gradually, the cataclysmic event on May 18 occurred within seconds of the 5.0-magnitude earthquake which apparently triggered it. The instruments around the volcano recorded no distinct indication of an impending slope failure or major eruption. Instruments were put back in place and research resumed soon after the explosion, but, as one volcanologist said, "Unless we get some changes in technology, maybe we can't anticipate this kind of violent eruption."

Don Mullineaux, who acted as the Geological Survey's chief scientific spokesman at the St. Helens site during the weeks preceding the mid-May eruption, later reflected: "People wanted specific answers. Every time I told a press conference the volcano could go on for weeks, months or years, or it could progress to a larger eruption, or it could stay the same, I saw the reporters just put their heads in their hands."

"Extinct" volcanoes have erupted

Mullineaux's frustration is easy to understand. Phrases like living and dead, active, inactive and extinct, awake and dormant, are hard to apply to volcanoes. Though a person who puts a volcano into any single category may live and die without seeing that label blown away, he may yet be proved dreadfully wrong. "Extinct" volcanoes—Vesuvius was one—have killed people, and some mountains, like Papua New Guinea's Mt. Lamington, have erupted before even being recognized as volcanoes.

The fact that St. Helens erupted doesn't necessarily heighten the prospects of activity elsewhere in the Cascades. Eruptions in a chain of volcanoes are as random as earthquakes along a fault; they can happen anyplace, up and down the line, rarely coinciding.

And yet, said Bob Christiansen, "It's fair to say that many volcanoes in the Cascades have the potential to erupt and several will be likely to erupt within the next few centuries." And then he added: "You say 'a few centuries' and it makes people complacent, because they take it to mean 'a few centuries from now.'

Terry Leighley of Sandia Laboratories installs camera that took a picture of St. Helens every 30 seconds.

U.S. Forest Service investigators take water samples to test for acid, solids and heat variations near volcano.

British volcanologist Basil Booth measures ashfall on a square meter of snow on a St. Helens slope.

Royal Ontario Museum, Toronto

This 19th-century painting by Canadian artist Paul Kane accurately showed eruption on St. Helens' north flank. Indian canoe in foreground is on Spirit Lake, which filled with mud and debris after May eruption.

It doesn't mean that. A few centuries is our standard of measurement. It could happen tomorrow."

And so, what of the other volcanoes?

Most of the snow-clad sentinel cones of the Cascades are called composite or stratovolcanoes, built of layers of lava and fragmental debris. One exception is Lassen Peak, at the southern end of the chain, which is notable for being the only other volcano to erupt in the "lower 48" in this century. Its spectacular plug dome was formed by the vertical extrusion of a vast, sticky body of lava; this knob hardened into a dome in which trapped gases exploded, shattering it and causing avalanches of hot gas, dust and blocks of rock.

Lassen's eruption began in the spring of 1914, but was unaccompanied by lava flows until after a year of huffing and puffing. Then, the following May, it suddenly sent a huge mushroom cloud about six miles into the air, spilled mud down its flanks, and unleashed a hot avalanche that felled trees three miles away. In 1917 the mountain quieted down.

To the north of Lassen rises—to 14,161 feet—the gigantic stratovolcano of Mt. Shasta (p. 57). Actually it consists of four overlapping volcanic cones and is classed as dormant but nonetheless dangerous: no lava in the last two centuries but plenty of steam to show it is still alive and kicking.

Still farther up the chain, in southern Oregon, is the mighty memorial of the mountain posthumously named Mazama. It blew up about 6,700 years ago and some 15 cubic miles of its 12,000-foot-high mass simply disappeared; the pumice and ashflows from its explosion blanketed an area extending from central Nevada into Canada. The eruption formed the caldera now known as Crater Lake (p. 57).

Going up the chain, Mt. Thielsen, the Three Sisters, Mts. Jefferson, Hood and Adams (pp. 56-57), and the remains of many older volcanoes intervene before St. Helens. Whether all these volcanoes are truly extinct or merely sleeping is any scientist's guess.

Intermittently active in postglacial times, Mt. Baker, the northernmost volcano in the American Cascades, evidently came close to erupting five years ago. Vapor clouds rose from its main vent, Sherman Crater, a few hundred feet below the 10,778-foot summit. Fumaroles in the crater suddenly discharged increased amounts of steam and hydrogen sulfide. Anticipating an eruption, scientists rushed to the mountain, 32 miles east of Bellingham, Washington, and the Forest Service temporarily closed resorts and campgrounds.

Baker did not erupt lava at that time, but a number of its lakes turned acidic and some of its snow-peaked, glaciated slopes were stained yellow and brown by the ash and chemicals the mountain exhaled (pp. 56-57). On past performance and from recent signs, it is still a dangerous volcano and bears close monitoring.

Between St. Helens and Baker stands the highest

Thousands of fir trees felled on St. Helens radiate out like spokes on a wheel, showing direction of blast. Deer and elk were killed or so stunned, one survivor reported, "You could go up and touch them."

peak in the range, 14,410-foot Mt. Rainier—a sleeping giant, by no means dead, with 26 glaciers slowly eroding its countenance (p. 56). There are steam vents and warm caves along the rim of its crater, and the peak has a history of producing massive mudflows. The most devastating one on record, identified by Crandell in 1956 as the Osceola Mudflow, was discharged 5,000 years ago and probably began as a mass of mud heated by steam vents near the summit. The avalanche traveled about 65 miles and stopped just short of the present-day sites of Tacoma and Puget Sound, inundating about 125 square miles under two and a half billion cubic yards of rock, mud and silt. Thirty-three years ago another mudflow carried 13-foot boulders across the main highway into Mount Rainier National Park, felling big trees and leaving a major mountain valley in total destruction.

Rainier was the first peak that Mullineaux and Crandell studied in relation to the threat it posed to human life, beginning their research there in the early 1960s. "We realized, as we walked through mountain meadows that were gorgeous with flowers, as we walked through areas that were just being developed, that the places we were enjoying on such nice summer days hadn't always been so wonderful," Don Mullineaux remembered. "They had been affected by past volcanic eruptions. They had looked very different once. They might be different again."

Volcanic hazards assessment involves determining risk from Cascades peaks that haven't had major eruptions in hundreds, even thousands, of years. There were those who doubted that the Rainier study was worth doing. Crandell and Mullineaux both heard jibes that they were vacationing in the mountains at government expense. Yet their 1967 report was enough to give any area resident cause for concern.

It was not an alarmist document; no visions of lava burying Seattle. Indeed, lava itself was perhaps the least potent of Rainier's weapons. Lava flows on mountain cones would be no direct hazard and flows down slopes, while they might endanger a few campgrounds, would be "minimal." As for pyroclastic eruptions of pumice, rock and ash, they would be "troublesome but not catastrophic."

If catastrophe came, it would come in the form of a mudflow like the Osceola Mudflow of 5,000 years ago. "If a flow as large . . . were to occur today," the report concluded, "it doubtlessly would result in wholesale destruction and death. . . ."

What should a prudent citizen make of the remote but ineradicable risk of another volcanic eruption in the Cascades? How does one weigh that risk against the prospect of centuries of serenity, of clean air, of heady scenery, of recreation? Mullineaux, Crandell and other geologists certainly don't believe that the residents of the Cascade region should pack up and

leave. But they do believe that land-use zoning plans should be created for critical areas around the volcanoes, that volcanic risk should be taken into account in the siting of dams and nuclear power plants, and that contingency plans should be developed for warning and evacuation of nearby communities.

If there is a positive aspect to the eruption of St. Helens, it is that people are now more apt to listen. "For 12 years," said Dwight Crandell, "I've felt we talked to an uninterested public. We understand that there are more immediate concerns—air pollution, cancer, so on. Volcanoes haven't erupted in a lifetime. Now people know there is one in their backyard."

The government may be more apt to listen, too. While the Earthquake Hazards Reduction Program (also under the Geological Survey) has an annual 1979-80 budget of $31.5 million, the Volcano Hazards Program receives only $1 million, 90 percent of which is spent on study of the volcanoes of Hawaii.

One thing is certain. Long after St. Helens has dropped out of the news, Survey geologists will be steering a difficult course between concern and alarm. They will continue to draw maps, chart possibilities, issue reports, meet with people who might listen to them. They would like to think that their findings will be weighed by land-use planners, by developers and power company officials.

"If we plan right now, we can save a lot of problems centuries from now," one geologist said near St. Helens. "I hope people are going to be here for a long time. The *volcanoes* are sure going to be here."

During the early stages of St. Helens' activity, a helicopter (center) with Survey geologists aboard flies through smoke and ash above the summit crater.

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The timeless striving of athletes to break records of the past and extend limits of human performance

By Jay Stuller

Sports scientists train athletes to defy old limits

By analyzing many neuromuscular functions with treadmills, test tubes and computers, researchers are learning what it takes to win

is symbolized in this painting, by Guy S. Fairlamb, of a runner who is competing in a race against himself.

The skies above Olympic Stadium in Mexico City threatened a mid-afternoon rain as long jumper Bob Beamon, representing the United States in the 1968 Olympic Games, sucked deep breaths of the thin air and gazed at the takeoff board more than 100 feet away. He had fouled twice during the previous day's qualifying round, and he told himself one thing: "Don't foul. Don't foul." Accelerating down the path, he reached a speed of approximately 24 mph, hit the board perfectly and converted his speed to an upward and outward thrust, the torque and force lifting his body five and a half to six feet in the air. He kicked his legs, running in space, raised his knees to an awkward, froglike position and then stretched them forward as he hit the sand in the pit. "It felt like a regular jump," Beamon said later. But it wasn't.

According to Dr. Ernst Jokl, a neurologist and professor emeritus of physiology at the University of Kentucky, it was "a mutation performance." Other physiologists claim it took forces that could have torn the athlete's muscles and broken his bones. Beamon's jump carried him an amazing 29 feet, 2½ inches, smashing the old record by nearly two feet. Jokl calls it the greatest single feat in the recorded history of athletic competition.

Was it? Did Bob Beamon reach the limits of human athletic performance on that October day in 1968? In the past, questions like these were likely to be settled by an argument and a wager. But a new field of research into the nature of athletic performance is providing a more scientific basis for the answers. Sports and exercise scientists are measuring and testing everything from athletes' muscle twitches to their mental traits, redesigning their diets and analyzing their physical movements by computer. Although sports science cannot yet predict whether a record like Beamon's will ever be broken, the information accumulated by analyzing outstanding athletes is benefiting aspiring athletes and improving their performances at all levels of competition.

In a sense, the development of sports science is an extension of the older discipline of sports medicine, which can trace its origins to the ancient Greek Olympics. Greek physicians called "gymnasts" were involved in all aspects of an athlete's training. One of the most renowned was Herodicus who was, purportedly, the teacher of Hippocrates, the father of medicine. The American College of Sports Medicine, founded in 1955, continues this tradition with a wide range of physicians and other specialists as members (including dentists, podiatrists, osteopaths, even veterinarians).

But sports scientists are now interested in far more than the prevention and treatment of injuries. At laboratories from coast to coast, they are studying athletes' physiology, biomechanics, biochemistry, psychology, kinesiology (the science of movement)—from toe to teeth.

An underlying assumption of sports science is that by analyzing the elements of athletic prowess, it should be possible to teach athletes to perform better. But how much room for improvement is there?

In 1934, young Brutus Hamilton, later the track coach at the University of California, Berkeley, set forth what he thought would be the "absolute ulti-

Jay Stuller is a free-lance writer whose sports career as a college basketball player lasted two years.

Amateur golfer Mary Meunch goes through paces in lab where Dr. Clein tests response to visual cues.

mate" to which track-and-field athletes could aspire. He lived to regret the predictions; by 1964, of the 14 records he had cited, all but two had been broken and none stands today.

Nonetheless, the 72-year-old Ernst Jokl, who won the German championship in the 400-meter hurdles while a teen-ager, believes that some of the records in the 20-odd track-and-field events are approaching their limits right now. Measuring the frequency and percentage of increase in record-breaking performances, he concludes that the improvements for male athletes are getting smaller and the times between them are longer. The curves are flattening out.

The graphs for women are now steeper than for men, but much of that can be attributed to sociological factors. Women were not encouraged to dedicate themselves to track and field to the extent that men have been, and only now are they catching up.

In distance swimming events, women today are easily surpassing Don Schollander's gold medal Olympic record in Tokyo in 1964, and the performance curves for both men and women swimmers are ascending.

Between the steep curves of the swimmers' records and the flatter curves for track and field, other sports offer varying possibilities for improved performances and new records. Improved athletes are not the only reason. New technology has also contributed. Design changes in the javelin, the switch from metal to fiber glass for vaulting poles, can make a major difference. Softer landing pits for vaulters, a pleasant innovation that replaced piles of sawdust, also eases what's called "the fear factor." Some artificial surfaces are "faster" for sprinters and easier on the legs of distance men. Shoes, too, can make a difference. Back in 1936, Adi Dassler, the founder of the German sports company "Adidas", made a special pair of track shoes for Jesse Owens. Such innovation still goes on.

But it is the development, preparation and training of the athlete's body for competition that is a primary concern of sports science. One busy practitioner in the field, Dr. Marvin Clein, is a former coach who has moved his work with athletes from the locker room to the laboratory. The 51-year-old kinesiologist is chairman of the physical education and sports sciences department at the University of Denver, where he uses the data from his research to model programs for individual athletes.

In analyzing the elements of physical performance, Clein puts his subjects through a rigorous battery of tests. "The first thing you look at when you test an athlete," he says, " is the ability to use oxygen. The individual's ability to accumulate oxygen debt during the high work loads is fundamental. Maximum oxygen intake per body weight is the measure of ability to sustain work over a period of time."

Secondly, Clein points to a powerful physical capacity, the ability to exert an explosive force, be it leg or arm power. This can be attributed to an anatomical advantage, a body structure suited to a particular sport. Indeed, some researchers and coaches have noted that world-class athletes in an event generally have similar biomechanical traits. Sprinters must have narrow hips to give them the mechanical advantage of running a straight line efficiently. Clein calls attention to the bowed legs of football running backs and the slight frames of distance runners.

A device in Clein's lab shows weight distribution on feet, seen in mirror; test is for posture problems.

There are many other traits Clein looks at, such as differences in muscle fibers, termed "fast-twitch" and "slow-twitch" fibers. A fast-twitch fiber reacts well to sports that require fast work of high intensity and short duration, such as sprinting; a slow-twitch fiber is better for sports that require endurance, such as marathon running.

In his Denver laboratory, Clein carefully studies an individual before recommending any performance-improving program, because each athlete has distinctly different needs. It may involve the kind of fine tuning needed by the Cleveland Indians' third baseman Toby Harrah, who had thigh muscles in one leg that were weaker than those in the other. Or Clein may work a complete transformation, as in the case of Leslie Covillo, a gangly 14-year-old when she came to him three years ago.

She wanted to be a runner and was hoping to go out for her junior high track team, but at first glance that hope appeared futile. She didn't know how to run and could not sprint efficiently in a straight line. She was tall and awkward, with painfully weak legs. "Those long legs are long levers," explains Clein, "but Leslie didn't have the muscle mass to move them properly. But as our tests progressed we found she had the things that gave her a mechanical advantage on the track: a great nervous system and the perfect body build for running."

These traits were not, however, obvious at a glance. Clein put Covillo through a series of tests, checking neuromuscular functions such as her "righting" reflex, seeing how quickly she could catch her balance when her equilibrium was disturbed, and her reaction time, seeing how fast she could respond to visual or auditory cues. There were exams on how she processed such information and psychological tests of her aggression, need for dominance and self-assuredness. "We also looked into her family background," says Clein, "to determine if it was supportive and encouraging. Which it was."

There were also measurements of the physical characteristics that separate the champions from the ordinary. "We looked at the length of her lower leg in relation to her upper leg," says Clein. "The width of her shoulders and hips, the length of her waist. All these factors have to be compared with her body mass. And then we compared her characteristics with what sprinters must do and the mechanical advantage they need for their sport." Covillo qualified.

"We had to evaluate her strengths and weaknesses," Clein says, "and then consult the research to see what she should do. First, she didn't have the muscle mass to move those levers, so we put her on a resistance program to increase her overall body power."

Curiously, not once during the six-month laboratory workout did Clein put Covillo on a track or time her in a race. "It was best to build that physiological base of success here," he explains. It also helped her psychologically, not allowing her to go to a track and have a bad experience. "As we retested her, she could make goals for herself here." Clein also taught her the art of dissipating nervous tension and relaxing.

Running while lying down

Because tension affects motor performance, Clein prescribed a special exercise for Covillo, a visualization of the races she would win. With his student lying on the floor, eyes closed, arms relaxed at her sides, Clein talked:

"You're tense, Leslie," he said. "You see the other competitors next to you. You feel the pressure, but you start to let it go. Feel the tension leave your body." Covillo's hands tensed, she relaxed her fist and wiggled her fingers. "You can feel it leaving your neck. Your shoulders get loose." Covillo twitched her shoulders, then rotated smoothly. "Okay, now you don't see the other runners, they disappear. They're not there anymore and it's you on the track. You're in the blocks. Ready, go!"

Covillo's knees pumped furiously as she flopped on the floor in an imitation of running while lying on her back. The style of the mimicry did not matter, for the race was in her mind. Then she stopped, and

To improve her figure skating, Lynn Smith runs on treadmill for Dr. Ogilvie's biomechanical evaluation.

Clein told her she'd run a good time, won the race.

"This programs the body and the mind for a race," explains Clein. "It sets a pattern of good things happening so she can get rid of that nervous tension in a competitive situation."

When Covillo did go out for her junior high squad, she set five records in her first year. She won the 100- and 200-meter races in the Amateur Athletic Union's Rocky Mountain Division and qualified for the Junior Olympics in three events. Now 17, she intends to go on running at the University of Oregon next year. "Her progression has slowed down," says Clein, "but she does have all the characteristics to be a high-class runner. She might have done OK if we hadn't tested her and put her on a special program, but she would not have done as much with all that innate talent."

The psychological factors that are a critical part of the training in Clein's lab become even more important in competition at the top of a sport. The psychology of record breaking is obviously inexact, but it is a terrible and sometimes frightening factor.

Dr. Bruce C. Ogilvie, a 59-year-old sports psychologist and professor emeritus at San Jose State who frequently works with Clein, has probed the minds of thousands of athletes, in questionnaires and lengthy interviews. He has consulted with numerous professional, college and Olympic teams and conducted personal counseling sessions with athletes who felt they had a mental block. In the 1980 Winter Olympics at Lake Placid, U.S. figure skater David Santee expressed effusive and public thanks for the help Ogilvie had given him.

The art of mental skating

"Athletes are basically an emotionally healthy group," says Ogilvie, "but the main mental interference in performance is self-doubt. And I don't think there is any athlete, gold medalist or not, who hasn't experienced self-doubt at one time or another."

When necessary, Ogilvie will sit with an athlete in exhaustive sessions that may last 18 hours. "The block is often subconscious," says Ogilvie, "but what we do is create a routine of positive actions where everything goes perfectly. We have the athlete rehearse this in the mind, a visual image of the performance."

Santee went through mental skating programs, including the one that nearly won him the bronze medal at Lake Placid. "David had experienced a near-total collapse in self-confidence," explains Ogilvie. "He'd had a series of unfortunate performances in a row, which build up in intensity. In this situation, one starts pressing, which makes it quite difficult to capitalize on motor gifts. And David has wonderful motor gifts, a beautiful set of genes for the sport."

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"WATCH YOUR STEP IN THIS PART OF NORTH CAROLINA."

If you pass through this part of the country, take things nice 'n slow. Because if you don't, you could find a Rabbit on your tail.

It's been chosen from a large line-up of cars to be a new member of the squadron.

Why the Rabbit?

Maybe it's because it offers a brilliant combination of acceleration and handling. The Rabbit jumps from 0 to 50 mph in 8.3 exhilarating seconds. Meanwhile the rack-and-pinion steering helps it handle some of the quickest turns on the trail.

And besides performance, there are lots of other things that make the Rabbit an easy overall choice. Take passenger space, for instance. The Rabbit has plenty of it. With enough legroom and headroom to fit four police officers – with their caps on.

In addition, it's so ruggedly constructed it has been compared to a Mosler safe. Which means it can take just about all the stopping, going, banging, slamming and bumping that the police can give it.

Shift after shift. Chase after chase.

Now, you're probably wondering which part of North Carolina the Rabbit is hiding in – well, we promised not to tell.

But if your foot ever gets heavy around here, you'll find out quicker than you can say Volkswagen.

VOLKSWAGEN DOES IT AGAIN

Ogilvie relaxes San Jose State baseball player Mitch Buich jr. as part of mental batting practice.

Santee, however, had lapsed into an attitude of passivity, and had lost his once-commanding presence on the ice. "We wanted to regenerate that deep feeling of self-affirmation," says Ogilvie. "We wanted to eliminate anything tentative in his approach." In the Games Santee fairly sparkled with ebullience.

For other athletes, improvement may come from understanding physical problems they could not see themselves. Dr. Gideon Ariel, who has specialized in both computer science and exercise science, is training the athlete's neurological patterns and functions as well as the traditional muscular functions by applying computer technology to sports.

The 41-year-old Ariel, a former discus thrower and member of the Israeli Olympic team, has a sports research center near Trabuca Canyon, California, and also conducts studies at CBA (Computerized Biomechanical Analysis, Inc.) in Amherst, Massachusetts. A current prize pupil is Al Oerter, the 43-year-old, four-time Olympic gold medal winner in the discus, who retired after the 1968 Games and is now making an amazing comeback. Oerter's longest Olympic throw was 212.6 feet (the current record is 233.5).

When he came to me 14 months ago," says Ariel, "we took some high-speed film of him throwing and compared his performance with those of previous years. He is slower, of course; age has slowed him down. But what we noticed was how inefficiently he had been throwing. He released the discus at the wrong angle, causing the throwing forces to be misdirected. The angle of his arm relative to his trunk was wrong for maximum leverage and his feet were leaving the ground when he needed maximum contact with the throwing circle. He was throwing only 180 feet when he came to us."

Ariel made a computer model of the Oerter film, which appears on a graphics display screen like a complex stick man. From this, Oerter could see on the screen right in front of him the elements of his throw. "Coaches can't see the subtleties of where technique is wrong," claims Ariel. "Your eyes can't 'see' forces or velocities. You have to calculate the results of numerous equations and present these graphically on the computer display to see the movements, to see what the athlete must change to optimize his actions and get the most from his force."

Using the computer and exercises to work on Oerter's neurological patterns—you train the muscles and the nerves, says Ariel—Oerter is much closer to his optimal performance. That may not be as high as some of the younger throwers, who may have a better biological advantage, but Oerter is now throwing 221.4 feet, far better than he did during his "prime."

If sports science has already begun producing better athletes, it is still a relatively unsophisticated science, and its developing techniques will undoubtedly produce even better results in the future. The use of steroids is an example.

Pill parity in the steroid race

Anabolic steroids are basically androgens, or male hormones, which help build muscle bulk and strength and are favored by athletes in many events from weight lifting, the shot put and discus to, more recently, running. Although illegal by international athletic rules (testing is conducted at all major international meets and during the Olympics) and available by prescription only, many athletes take them indiscriminately, with the attitude that "if two pills (or injections) are good, ten can get them a medal."

And this has them flirting with potentially dire consequences; prolonged and overuse of steroids can lead to sterility and sexual dysfunction. In some Eastern European nations, elite young female athletes are said to be given hearty doses of the substance at key points in their careers. In the United States, athletes take steroids by choice, but the effect is quite similar to an arms race; if the Soviet throwers are getting so many steroids a day, an American must have pill parity or lose. "You can't be world-class without steroids," says one flatly. But Ariel sees sports science as only at the first stage of understanding such chemicals. "Next is looking at the chemistry of the body," he says. "And I hope it can be done naturally.

"The muscle cells store fat and carbohydrate [the latter as glycogen] which break down chemically to

What to do if your body's in Peking but your heart's in Poughkeepsie.

It's business as usual. You're in a strange hotel. In a strange country. Meetings all day long and client dinners at night. All you can think of is home.

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restore ATP [adenosine-triphosphate], the body's immediate source of energy for muscle contraction. You only have so much ATP in your body and in a sprint, for instance, you burn it up. A 100-meter man can exhaust his supply, accelerating all the way. But a 400-meter man must pace himself or he will exhaust his supply too early in the race and slow down."

Ariel feels that there may be a nutritional way to stimulate ATP production naturally, to give an athlete more to work with. "Then there is no reason a sprinter can't go all out in a longer race."

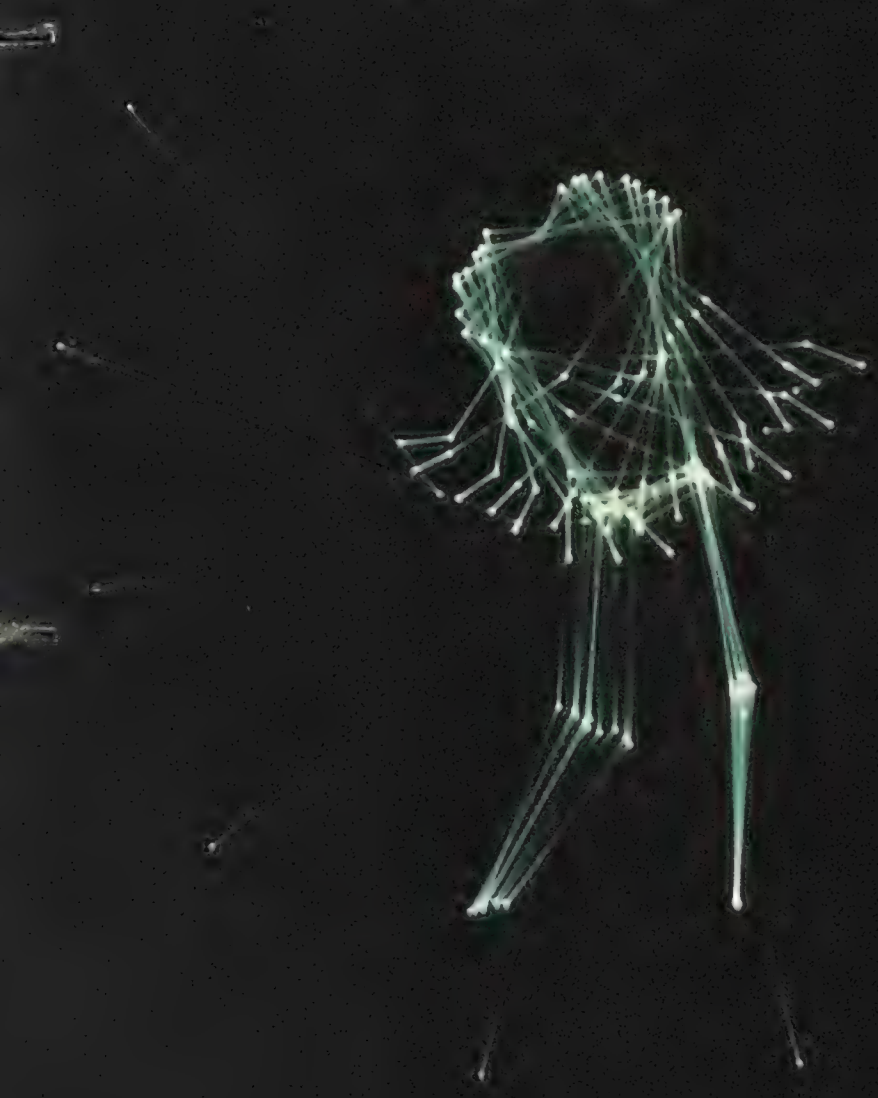
Another exercise physiologist agrees that the field is in its infancy. "In talking about the limits of human performance—how good can you get?—it leaves the impression that we really know, and we really don't," says William J. Fink of the highly regarded Human Performance Laboratory at Ball State University in Muncie, Indiana. "In a sense, we lag behind the superb athlete and the superb coach because they are at a level of performance which we could not predict, but we can study them and find out or describe what's going on in their bodies and draw up some general conclusions that would be helpful for the average athlete. Sometimes we wonder whether we can create a champion," Fink muses. "When you get a group of world-class competitors together in any given sport, and test them, you find that they become indistinguishable from each other. So it becomes impossible to predict which one is going to be the winner. I still think we are a long way off from making champions."

So there is still no very sure answer to the questions posed by Bob Beamon's record-breaking jump in the 1968 Olympics. There have been efforts to discount Beamon's leap, put an asterisk next to it for "altitude." Indeed, a lower drag coefficient of the air in Mexico City may have accounted for some of his performance, as well as the fact that the city sits on a spot on the Earth that has a gravitational pull about one-sixth of one percent under what Beamon might have expected, say, in Los Angeles. Some analysts have factored in an environmental advantage of nearly nine inches, which still leaves a foot in the "mystical" category. "Beamon's performance was extraordinary," says Ernst Jokl. "But if it happened once, we can't ignore the possibility that it could happen again."

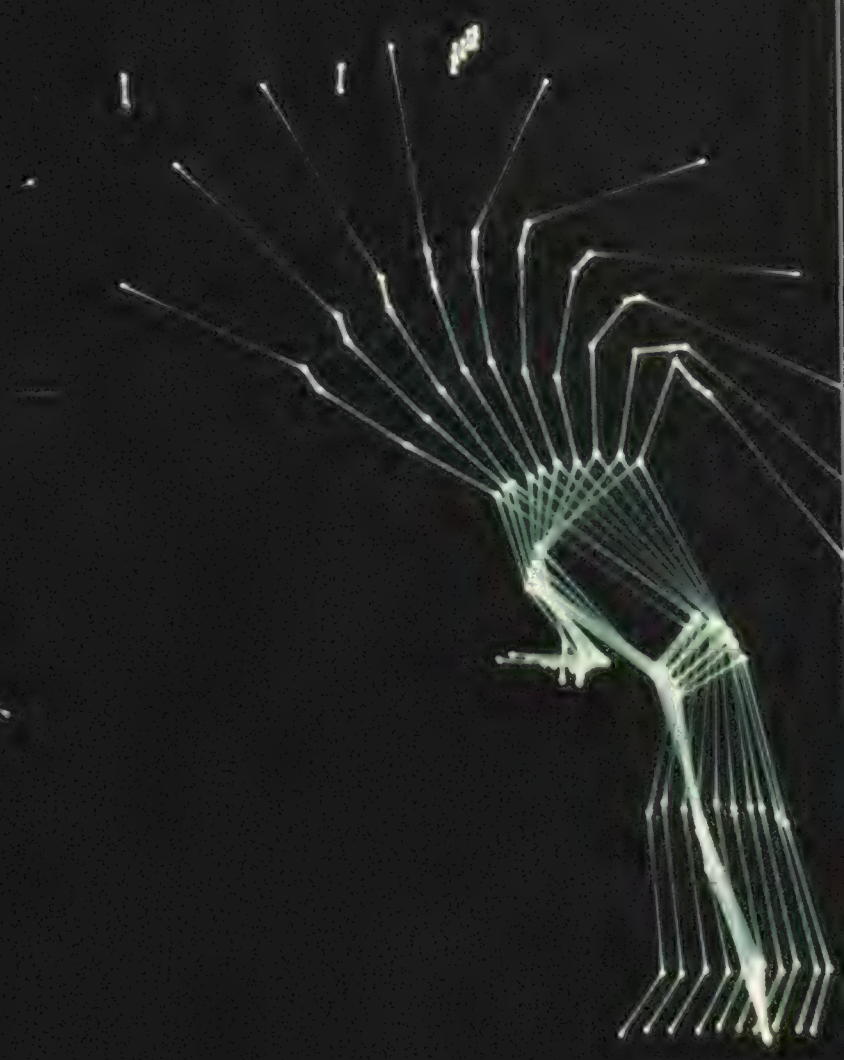
Ariel's computer analyzes athletic performance into elements, displays stop-action motion on screen. Images opposite, made from films, show nature of championship golf drive, tennis swing, marathon pace.

Dr. Ariel gives colleague a workout on computerized exercise device that provides readouts of performance.

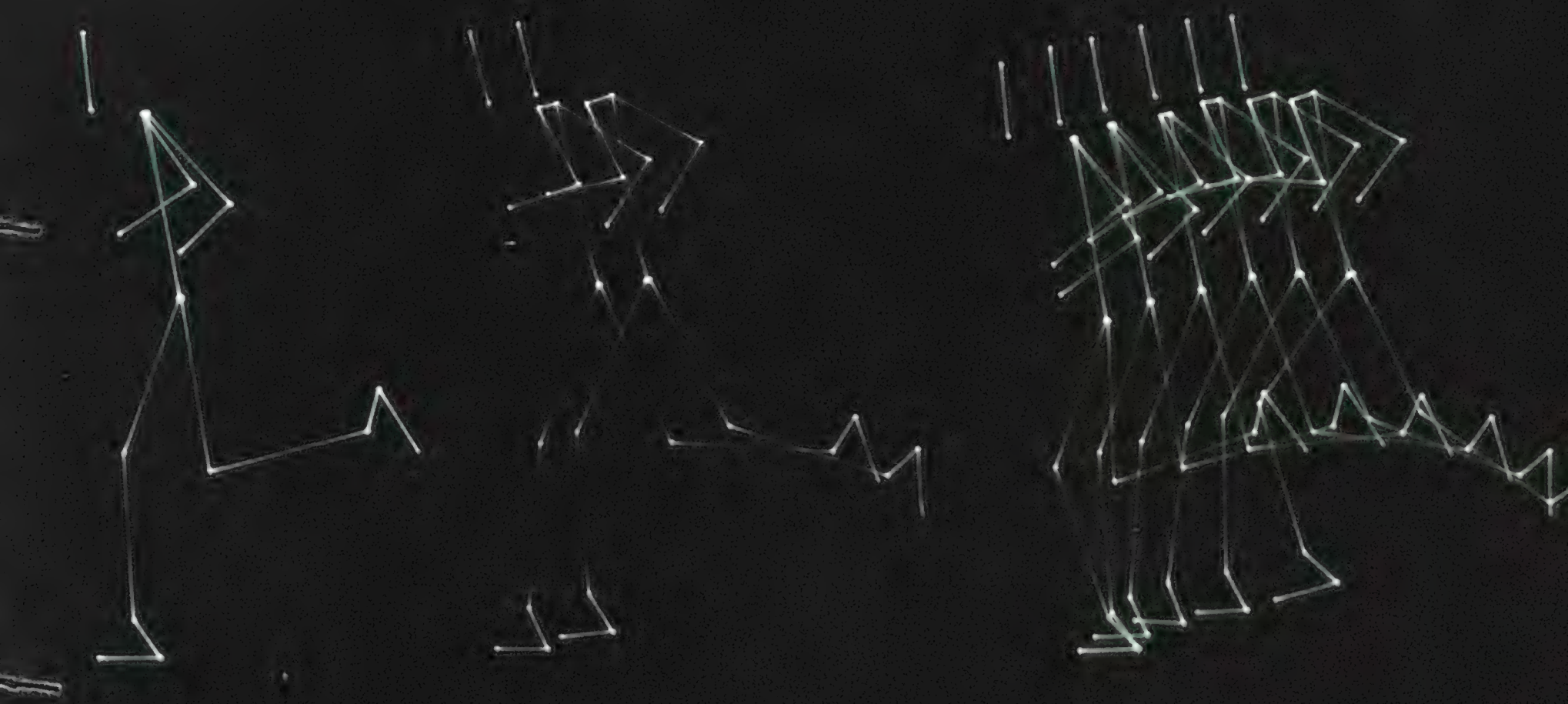
Jack Nicklaus' golf drive



Jimmy Connors' tennis serve



Bill Rodgers' marathon pace



IT'S WORTH A $60,000 MORTGAGE.

This house is located in a worn-down neighborhood in an American city. The neighborhood is not completely gone, but it's hurting.

Urban neighborhoods like this have the potential to recover—to become places where people would like to live. We'll stake money on it.

PEOPLE MAKE VALUE

Many people feel they'd miss something by living in the suburbs. The city offers diversity, history, culture and convenience. Urban public transportation means freedom from the automobile. Many city houses have character and architectural interest. And since more people still choose the suburbs, housing in the city can be a good buy.

PEOPLE MAKE A MARKET

If people want housing in the city, there can be a housing market in the city. Lenders of mortgage money, recognizing this change, can see that this house is worth a lot to someone. When it is rehabilitated, it will be worth a $60,000 mortgage. We can see it now.

We're Fannie Mae, the Federal National Mortgage Association. We are a shareholder-owned, profit-making corporation, with a specific purpose. Our job is to help meet people's housing finance needs. We don't make loans, but by buying mortgages from local lenders who do, we replenish the lenders' supply of funds so they can grant more mortgages.

In addition to our regular mortgage purchase activities, we have set up a series of special programs that use our position in the home finance market to encourage more mortgage lending in urban areas.

FANNIE MAE'S REHABILITATION LOAN PROGRAM

Under our rehabilitation loan program, a lender would be able to grant a $60,000 mortgage on a house like this, even though in its present condition it may have a market value of only $35,000. Its value, when rehabilitated according to approved, detailed plans, would be about $63,200. A lender taking advantage of this program could grant a mortgage based on the completed value of the house, rather than on its present value. The buyer who is qualified for a 95%, 30-year conventional mortgage would be required to put 5% down and would receive $60,000 as a mortgage loan—95% of the house's completed value. $35,000 would go directly to the seller of the house, and the rest would be placed in an escrow account administered by the lender, to pay for the rehabilitation.

Home buyers used to have to go out and persuade someone to give them a construction loan for the rehab work, with separate transaction costs, a short-term payback and a higher interest rate. Now they don't have to.

GETTING THE WORD OUT

If no one knows about our programs, they won't do much good. Fannie Mae people from each of our five regional offices go out into the cities and tell lenders what kinds of mortgages we will buy.

We also try to convince them of what we already know—that making urban loans is good business for us, for lenders and for the community. People want urban homes, and Fannie Mae believes that properly underwritten urban mortgages carry no more risk than those on suburban properties.

LOCAL PARTNERSHIPS

We work with community groups, local governments and local lenders to get neighborhoods turned around. It's already working in neighborhoods in such cities as Memphis, Philadelphia, Los Angeles, Toledo, Seattle, and Dallas.

The city government has to be involved, because a neighborhood will not improve unless essential services are maintained or re-established. Building codes have to be applied sensitively to rehabilitated structures.

And there must be a lender committed to lending mortgage money. Community groups have often seen lenders as unapproachable. They're not. Fannie Mae is in a good position, with its ongoing relationship with many lenders, to bring them into the partnership.

But most important, people in the community must make a commitment to preserving and improving their neighborhood.

People want to live in cities. That means there is economic life to be brought back into cities as well. It is people who make this house worth a $60,000 mortgage. All our complicated real estate and financial transactions are, simply, a response to what people want.

WHAT IS FANNIE MAE?

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FANNIE MAE America's Mortgage Resource

Photographs by Robert Noonan

The swift spider that is nature's smallest 'angler'

An agile arachnid may lure fish within range, or spring from submerged perch to catch minnows, insects and other aquatic small fry

Clinging to submerged stem, *Dolomedes* is covered with air bubbles; if it lets go it will bob to surface.

Edward Spring, walking through a New Jersey swamp in 1859, saw a splash. Taking a closer look, he discovered a spider fastened to the back of a struggling fish. To his amazement, the spider caught hold of an embankment with its hind legs, then tugged and hoisted the fish out of the water. The spider, he reported, was three-fourths of an inch long, and weighed 14 grains; the fish it caught was three and one-fourth inches long and weighed 66 grains (one grain equals .002 ounce).

A spider that can land a fish several times its size? The report was called fanciful at first, but the spider (*Dolomedes*) continues to amaze the scientists who study it. The fisher spider (the species shown in these photographs is *Dolomedes triton*) is found throughout the eastern United States and on every continent except South America. Unable to swim, the fisher nonetheless walks and skates gracefully across the surface of the water, dives into it, and scoots from one underwater foothold to another—to escape predators and to stalk passing fish. Its ancient symmetry translates into powerful machinery as it seizes, subdues and hauls its prey from the water.

The fisher spider is most often seen at the edge of a pond or stream, rear legs anchored firmly to a twig or leaf and its remaining legs and pair of pedipalps (short leglike appendages at the front of the body) gently pressed to the water's surface film. In this position it patiently awaits telltale vibrations made by an insect on the surface or a fish below.

Unlike many other spiders, which spin a web and then wait for their prey to become ensnared, the fisher spider actively pursues its prey. The water's surface is the "web" for this aquatic hunter. If an insect falls onto it, the surface tension will trap it there while the fisher, buoyed by water-repellent hairs on its underside, skates over and snaps it up.

Catching a fish is more complicated. Recent research suggests that the spider may actually "tickle" the water's surface with its pedipalps to attract nearby fish. When one swims over to investigate, the spider jumps on it (opposite).

The fisher may also pursue its prey from under water, by diving to a submerged stem and ambushing the fish as it swims by. Diving must be done with authority; the spider needs a hefty pushoff from its above-water support toward its underwater post to offset its light weight and the added drag of air pockets caught in its body hairs. Once at its station, the fisher hangs on firmly until it pounces on its target or dives for a better vantage point. If it were merely to let go, it would bob to the surface like a cork.

Though the trapped air bubbles around its body hinder underwater maneuverability, the fisher needs them. All spiders breathe through orifices located on the lower side of the abdomen. Air bubbles trapped

Pouncing on prey, the spider (shown about five times life-size) sinks poison-equipped chelicerae into fish.

After struggling for some 30 seconds to shake off its tiny attacker, the fish is stilled by the venom.

in that area provide a continuous source of oxygen, allowing the fisher a half-hour or longer for each foray.

Once *Dolomedes* has caught a fish, it must get it to a dry place. Otherwise the digestive enzymes it injects into the fish's body would be diluted. Holding with its chelicerae, fanged structures on each side of its mouth, the spider maneuvers its catch to shore and pulls it up out of the water. Then, hanging upside-down from a twig, it can feed on the suspended fish (far right). The astonishing strength indicated by this feat is due to many factors, including the spider's bamboolike tubular legs with superb musculature.

Dolomedes is not the only aquatic spider in the world. A distant cousin, the genus *Argyroneta* (found in Europe and temperate Asia), can actually swim, and makes its home under water. It builds an underwater silk platform, then makes a series of trips to the surface, each time capturing an air bubble under its raised abdomen. Ferrying the bubbles to the bottom of the platform and releasing them, it creates a "diving bell."

But *Dolomedes* is a true vagabond, and not fussy about where it takes its rest. The shelter offered by a fallen leaf or decaying log serves nicely. In most other respects, life is much the same for *Dolomedes* as for other spiders.

No one is certain exactly how long an average fisher spider lives, but, says the Smithsonian's Ralph Crabill, it's undoubtedly at least two years. Considering that some species of mayfly live for only one day as adults, he points out, that's a pretty long life-span, and lots of time for fishing. Yet, catching a fish isn't an everyday event for *Dolomedes*. According to James Carico, an arachnologist at Lynchburg College in Virginia, some fisher spiders may never catch a fish in their lives. They may just prey on insects, while pondering the big ones that got away.

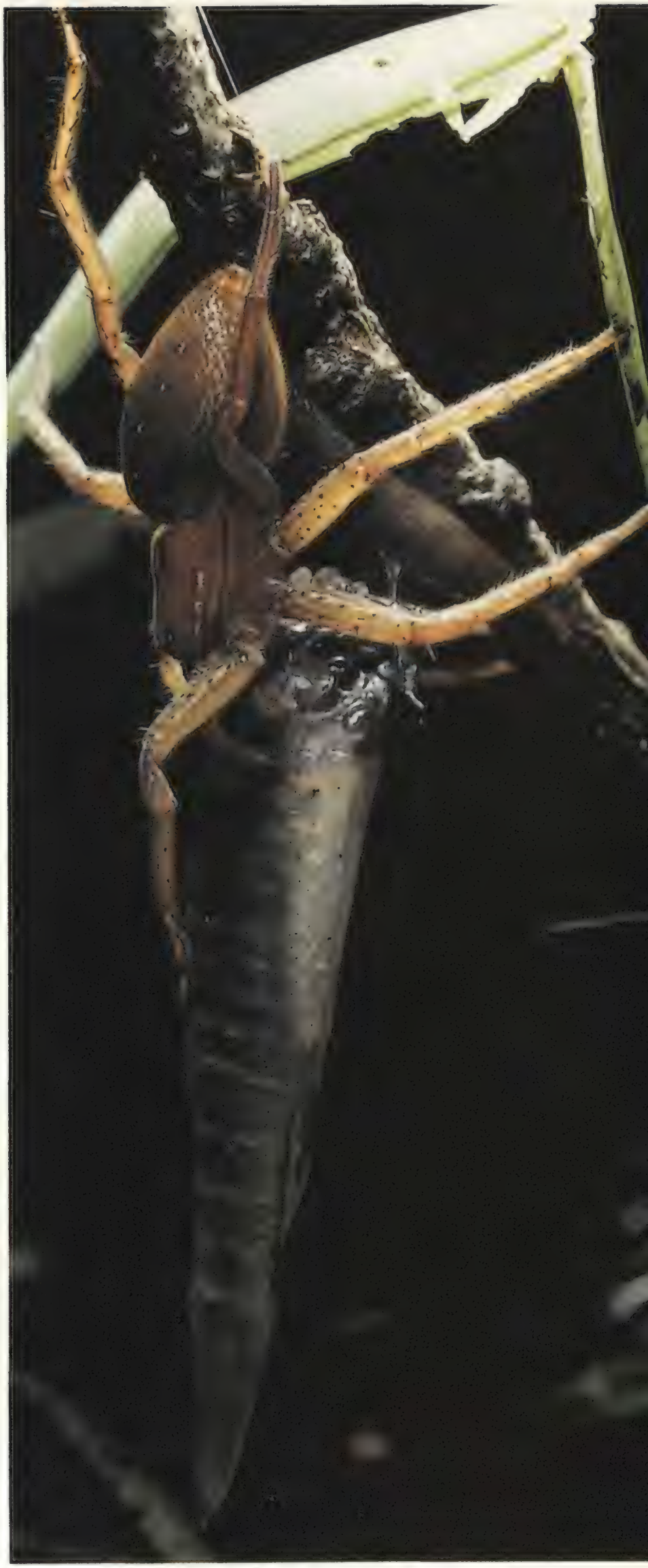
—Constance Bond

Advancing over stunned catch, fisher spider prepares to thrust its chelicerae a second time.

Pair of chelicerae is on a discarded exoskeleton, a horny outer skin the spider sheds periodically.

Despite eight eyes, spider sees little; sensory hairs on its body detect the prey's movement.

After the meal, fisher spider grooms by pulling appendages one at a time through its cupped fangs.



With trapeze artist's skill, *Dolomedes* hangs pendant from branch while grasping and polishing off meal.

Poised above surface, spider awaits next victim. It may "tickle" water to attract fish.

By Betty-Bright Low

Pyrotechnic paeans have been flying high for 600 years

The rocket and star-shell salutes used today are live echoes of the great extravaganzas put on by the royal firemasters centuries ago

Fireworks: they sizzle, sparkle, thunder, pop and glow. They can take your breath away. Dangerous and expensive, with life-spans short enough to clock with a stopwatch, fireworks are so compelling that Man, for more than 600 years, has rocketed their glittering particles into the sky to inaugurate, to celebrate, to commemorate. Pyrotechnic salutes have traditionally greeted kings and presidents, national achievements, public holidays and heroes.

The skyborne spectaculars that we see most often today—at state fairs, the Super Bowl and everywhere on July 4—were the favorites of Germans and northern Europeans as long ago as the 14th century. Stationary "set pieces" (frames with fireworks mounted on them to form special designs) were more popular in southern Europe and Italy. Both types are still used separately and in combination (opposite), often with music, to create dazzling productions of light and sound around the world.

Who sent the first rockets blazing into the night? No one yet knows for sure. Whether the inventor was Greek, German or Chinese, Muslim, Jew or Christian is a matter of conjecture. Romantics cling to the notion that traders like the 13th century's Marco Polo returned to the Mediterranean area with reports of artificial fires they had witnessed in China or India. Others staunchly claim that fireworks originated with the cannon supposedly invented in Freiburg in the 1300s by a magician, monk or alchemist known variously as Berthold Schwartz, Black Berthold and Berthold the Black. Some scholars trace pyrotechnics to the *Liber Ignium* (Book of Fires) written by Marcus Graecus in the 13th century. Still others credit Roger Bacon and Albertus Magnus, who both included in their 13th-century writings gunpowder "recipes" that may have been developed from Arabic sources.

No matter what future research may prove, fireworks for jubilation first emerged from ancient ritualistic fires, and their form is solidly linked to the history of artillery. Mortars, rockets and bombs that gunpowder brought to military ordnance stores soon became part of the entertainment world as well. Best qualified to demonstrate the new "artificial fires" were the military engineers trained to handle volatile weapons. These officers were the firemasters both for battle and for celebration. As their competence in handling gunpower increased, a display of recreational fireworks changed gradually from being a curiosity to being an art form.

Amusement as fleeting as a kiss

The expense of pyrotechnic shows grew accordingly. Reminiscing about the fireworks during his youth in 15th-century Siena, Vannoccio Biringuccio wrote that their cost and transiency reserved them for moments of special rejoicing: ". . . those times were truly golden, that is, they had much gold to spend for things . . . and fireworks had no other purpose than amusement and endured no longer than the kiss of a lover for his lady, if as long." This extravagance made fireworks ideally suited for marking treaties, victories, religious festivals, coronations and important marriages. The most wealthy and powerful sovereigns of Europe vied for the most able and imaginative firemasters. The new art form was patronized at the highest levels, the royalty of church and state.

By the 16th century, the firemaster had accumulated many helpers. His troop included craftsmen—masons, turners, joiners, carvers, painters, carpenters, plasterers and braziers—to prepare shell casings and set pieces. And he had a complement of Green Men, or Wild Men, as they were sometimes called. These were the sooty, ill-kempt fellows who wore caps of green leaves, brandished sparking fire-clubs, cleared the way for European royal processions (all the while keeping public excitement at fever pitch) and set off the fireworks. The royal progress to Anne Boleyn's coronation in 1533 had its "monstrous wild men casting fire and

For a 1976 tribute to Thomas Jefferson in Washington, French fireworks experts, the Ruggieris, combined an aerial display with set piece outlining Monticello.

Green Man or Wild Man showers sparks to herald 16th-century royal tours, then to ignite fireworks.

making a hideous noise," and John Bate published a drawing of one (above right) in his essay, "The composing of all manner of Fier-Works for Triumph and Recreacion . . .," in 1634.

The firemaster needed this full production team to build the complex machines for his display because a complete show encompassed three elements—earth, air and water—in addition to fire. Specifics on creating these extravaganzas were transmitted by word of mouth, by apprenticeship or as an afterthought in gunnery guides. A 1620 French guide showed how to combine a ship, a river and pyrotechnic devices to create an aquatic spectacular: atop the ship's mast, either a sunburst or the name of a prince or great seigneur emblazoned on a flaming drum; on the deck, fighting men with flashing weapons and musicians sounding fanfares with drums, oboes and trumpets.

Music was often included in the displays. John Babington, in his 1635 *Pyrotechnia*, showed a primitive music box activated by a "fire wheele" with instructions on "How to present musick playing (by the help of fire) with anticks dancing." A 170-piece orchestra accompanied fireworks on the Seine to celebrate the marriage of Madame de France to Philippe of Spain in 1739. In England ten years later, Handel composed *The Musick for the Royal Fireworks*. Today a California firm produces sky concerts with the fireworks timed to music, but the thunder of mortars and bombs usually overrides the musical effects.

In our nation's Capital this past April, the Zambelli fireworks company revived the wedding of royal fireworks to music, this time for an American audience. Twenty-five thousand people clustered around the Washington Monument for a "Royal Welcome—A Salute to Belgium," the musically synchronized display that opened a festival celebrating Belgium's 150th anniversary of independence. Unfortunately the guests of honor, King Baudouin and Queen Fabiola, who had just flown in, succumbed to jet lag and were snug in bed at nearby Blair House when rockets of the first tableau blasted off to the strains of Brussels' anniversary theme. With a 20th-century twist, spectators amplified the music from scattered loudspeakers by tuning their portable radios to a local station's simulcast. Handel would have been pleased.

Mrs. Low's interest in fireworks was ignited at Delaware's Eleutherian Mills Historical Library.

Until the 19th century, the dragon was the most popular ingredient of fireworks spectacles. Pyrotechnic manuals gave directions for constructing the "fearsome creature" which had been an integral part of displays as early as the 1480s. Whether propelled with wheels on water, or along a line in the air, or simply across the ground, the dragon—with or without wings—had a skin of painted papier-mâché or colored isinglass and a rib cage of whalebone or willow rods. Small rockets were mounted alongside each rib and larger ones placed in the belly, tail and mouth (opposite). A firemaster ignited the monster as one single piece or in an incendiary encounter with St. George (himself ablaze), or a glowing savage, or a second fiery dragon. The belching holocaust of such combat delighted the Dauphin of France on his fifth birthday in 1734.

Even a rocket-filled dragon needs a fitting environment in order to perform at its fire-breathing best, so the art of fireworks had to include the creation of appropriate settings. The noted firemaster Casimir Simienowicz, in the service of the King of Poland, was

Bruce Bassman loads mortars for 1980 U.S. display honoring Belgian royalty; he also synchronized music.

the first to write an etiquette book for his craft. In *The Great Art of Artillery,* in 1650, he did more than reveal his recipes for pyrotechnic displays. His lengthy essays unrelentingly tied fireworks to symbols of classical antiquity: Neptune, Juno, Mars, Minerva, Diana, Apollo, the Graces and sundry naiads and satyrs.

Simienowicz taught his disciples how to represent conquered cities, honor the sovereign, display conviviality, enhance a wedding and observe saints' days in the most fitting way. A firemaster had two responsibilities to the special occasion: "Decorum" ("making the whole Aspect of a Fabric so correct, that nothing shall appear but what is approved and warranted by some Authority") and "Oeconomy," which governed design, time, season and expense. For coronations, Simienowicz advised that "Princes . . . may be very seasonably reminded . . . of the . . . Incertitude of Prosperity, by a Sight of the *Wheel of Fortune. . . .*" In a plea for Oeconomy: ". . . all these works [set pieces] should be exposed to public View in the Day-time; for otherwise to what purpose would it be, to bestow so much Time, Labour and Cost, upon a thing which is not to burn above a few minutes, and that at a Good Distance from the Spectators . . . amidst the Darkness of Night?"

Pyrotechnics in their proper settings now became like plays in a theater. The firemaster was a theatrical producer. In 1664 at Versailles, firemaster Vigarani coordinated a magnificent festival, "The Pleasures of the Enchanted Isle," to which Louis XIV invited some 600 guests. A three-day program of banquets, ballets and mimes, embellished with Lully's music and Molière's comedy, culminated in the pyrotechnic demolition of the island. Fire consumed three battling sea monsters just before the entire Palace of Enchantments flared into the night.

Less and less notice was paid to Simienowicz's Oeconomy as pyrotechnics reached their zenith in the 17th and 18th centuries. Competition to produce the most fantastic displays existed among the cities of Europe as well as the courts. After the peace treaty of Aix-la-Chapelle was signed in 1748, fireworks on a lavish scale were used for celebrations in Paris, London, Dublin, The Hague. In Paris and London there were "ignition disputes" among the several firemasters imported to produce the spectacles, and accidents resulted. In London the argument was whether to ignite with the traditional "quick match" or a "train" of gunpowder. The train won out—and caused an explosion that destroyed part of the theater. In Paris the disagreement centered on whose display would be presented first. When French and Italian firemasters lit their creations simultaneously, they killed 40 people.

The handling of gunpowder, dangerous at all times, has, through the centuries, claimed countless lives including those of firemasters and their assistants. Simienowicz advised everyone working with fire "to have a continual Eye upon Heaven. . . . For the acci-

Completed, fire-breathing dragon at top hovers above its disassembled parts in 1650 artillery guide.

Fireworks' aristocratic heritage

Unexcelled Fireworks Company (this is its catalog cover, 1888) hired immigrant pyrotechnists.

dental Shock of two Stones, the hasty Attrition of two Strings, nay the very impetuous Rubbing together of two Straws, may be the Death of you. . . ." Many early pyrotechnists concluded their writings with recipes for unguents to salve burns. Asked recently how he recruits workers for such a hazardous business, one American manufacturer made a case for people with no previous fireworks experience. "That way we know they'll form the right habits. Everything that has to be moved must be *picked up*, never *pushed*—or we'd all be blown up." But the worst sometimes happens. As recently as last May, at a fireworks factory in Spangler, Pennsylvania, a devastating explosion killed one worker and injured 11 more.

Centuries ago, dangers also existed for the crowds that came to watch the fireworks. In Nuremberg as early as 1533 the firing area was cordoned off to protect the onlookers. Such precautions were not always enough. While Britain's Elizabeth I reveled in a show at Warwick in 1572, flaming debris from squibs and shells set fire to some nearby houses and incinerated one man and wife who were peacefully asleep in bed.

Perils of smoke and spectators

Fiery accidents were not the only risks. In 1629, Francis Malthus advised pyrotechnists to choose for their displays "fires of Joy" instead of "fires of War" because the former did not "require Venomous smokes to poison the spectators." The crowd itself could be a threat. In 1770 when the city of Paris hailed the marriage of the future Louis XVI to Marie Antoinette, sightseers so mobbed the Place Louis XV (today's Place de la Concorde) that at the end of the display they could not easily disperse. The resulting crush killed and injured hundreds. Afterwards, in a sympathetic gesture, the royal newlyweds distributed their monthly allowance to the victims who needed help, but the public stayed resentful.

Fireworks have played a role in a least one international incident. The astonishing spectacular held in 1804 on the Seine to celebrate the self-coronation of Napoleon, with Pope Pius VII presiding, featured set pieces mounted on barges near the bridge of Notre Dame. The display portrayed Napoleon's famous 1800 crossing of the Great St. Bernard Pass on his way to what would be a military victory in northern Italy. It was to culminate in the ascension of a gigantic hydrogen balloon decorated with colorful insignia and carrying a golden crown hung with lanterns. The pyrotechnics burned flawlessly and the balloon rose on cue, but it unfortunately floated all the way to Rome and deposited the crown on Nero's tomb, badly unnerving a superstitious Napoleon. (Remnants of the balloon were brought back to France as spoils of war in 1814.)

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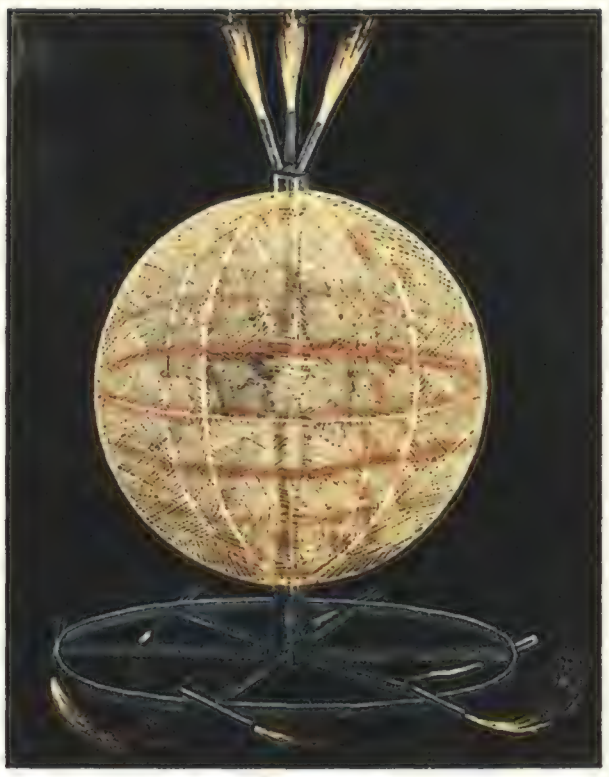

These exhibition pieces appear in the 1869 catalog of H. P. Diehl & Company, Cincinnati. Advances in technology made possible the delicate (from left) Ladies' Whims, Sparkling Caprice, Turkish Cross.

Balloons were just one of the innovations employed by pyrotechnists. The development of gaslight challenged their ability to combine different types of illumination. In New York City, to celebrate the opening of the Erie Canal in 1825, engineer Richard Willcox had to create a display that would transcend the brilliance of 2,306 lamps and candles placed around the outside of City Hall. To do it he used "thirteen gerbes" that threw showers of sparks, "fifteen hundred large fire balls, crossing and intersecting each other at different angles . . . accompanied with showers of gold and silver rain. . . . During the exhibition three hundred and twenty rockets of four pounds each—thirty of nine pounds—and twenty-four of twenty pounds were projected—the heads of these tastefully diversified with scrolls, serpents, snails, silver rain . . . so as to fall into the North [Hudson] River."

Although Americans had imported the tradition of fireworks—as well as the shells and rockets—from Europe, they started making their own pyrotechnics in earnest as the 19th century progressed. Some of the manufacturers were Unexcelled Fireworks of New York and St. Louis (p. 88), H. P. Diehl of Cincinnati (above) and Church & Clark of San Francisco. Many immigrant pyrotechnists went to work for these companies, as did their sons, thus transplanting to America a traditional family craft. Fireworks professionals are a close-knit group. Generation after generation, single families have continued to dominate the field. From Italy to the United States came the names Zambelli, Grucci, Serpico. From England, Brock and Pain. In France and America, the Ruggieris have entered their third century of fiery displays (pp. 84, 92).

In spite of a borrowed tradition, Americans never aspired to Louis XIV's lavish splendor or to Simienowicz's neoclassical scenarios. Almost until this century, major displays in the United States followed Willcox's lead and centered on a particular local landmark. British pyrotechnist Arthur Brock produced the most stunning in 1892 when he used the Brooklyn Bridge (SMITHSONIAN, October 1972) as a mammoth set piece for a shimmering simulation of Niagara Falls. He magnified the effect created in 1886 by the Unexcelled company for the Albany, New York, Bicentennial: "The grand exhibition," proclaimed the *Albany Express*, "closed with a monster set-piece representing the Falls of Niagara . . . cataracts of fire poured over lofty heights above which rose clouds of fiery spray."

While the scenery for fireworks displays became more complicated, the technology had undergone little change by the early 1800s. A good show still depended on clever combinations of, or variations on, basic recipes dating from the old artillery manuals. Willcox's glowing showers over New York's City Hall differed little from those described in 1684 by innovator John White: "To make the golden Rain, you must get store of Goose-quills, and cut them off next the feathers, and fill these quills hard with the same composition that is in your Rocket. . . If it were possible to put a thousand of these quills upon the head of a Rocket, it were a dainty sight to see how pleasantly they spread themselves in the air, and come down like streams of gold much like the falling down of Snow, especially if the wind be any thing high." Designs for

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wheels, suns, obelisks, trees and Chinese mirrors still matched carefully sketched diagrams in timeworn, handwritten recipe books.

Pyrotechnic technology leaped ahead later in the 19th century. Advances in color chemistry, particularly the use of potassium chlorate, put new tints in the sky. "Lance work" (filling small paper cases with combustible material for fastening to set pieces) made new devices and theatrical styles possible. A "Grand Competition of Pyrotechnists" at the Crystal Palace in 1865 started a trend toward pictorial set pieces. Huge frames supported thousands of gleaming lances that outlined historical, fictional and current events: "The Burning of Moscow," "The Wild West," "The Bombardment of Sebastopol."

Within 20 years, portraits of famous people and transformation pieces (where one image changes into another) joined the repertoire. With two full sets of lances arranged on a frame, the first blazing picture camouflaged the design of the second, which then ignited as the first flickered out. A pyrotechnist's assistant made a monumental mistake at Queen Victoria's jubilee. Floral emblems were supposed to blossom into portraits of the royal family. And they did, but a faulty adjustment caused one of Her Majesty's glowing eyes to wink at the startled crowd.

One hundred years later in Boston, the Grucci family suffered an exasperation of a different kind at the dedication of the John F. Kennedy Library. "We were going to have a big display of JFK's face on the front lawn," Felix Grucci later complained. "We brought it all the way from New York and then somebody scratched it at the last minute. It cost us a fortune."

After centuries of ever-enlarging public displays, a trend toward simplification was probably inevitable. In America, the Depression years marked a decline in the popularity of huge set pieces. John Serpico, a third-generation pyrotechnist, remembers the days when theatricals like "The Transatlantic Flight of Lindbergh" and "The Last Days of Pompeii" were the vogue. In the 1930s he saw the framework for such spectaculars dismantled, numbered and stored in his father's 3,600-square-foot warehouse to be ready for the reconstruction that never came. Long-needed regulation of the public use of explosives also had a dampening effect.

Today's fireworks revival, with its strong taste for aerials, in a sense completes a searing circle that goes back to 14th-century Germany. But a look at the 1980 list of special effects offered by the Zambelli company—laser light, whistling tracers, multibreak shells—shows that modern pyrotechnics are infinitely more sophisticated than those the Green Men knew. And safer, too. Besides, the fire engines now stand by.

The Ruggieri family created this Paris spectacular in 1830 to celebrate the July 27-28-29 overthrow of autocratic Charles X in favor of "citizen king" Louis Philippe. The dates glow above set-piece roof.

Courtesy of the Etablissement Ruggieri

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1 Between 1959 and 1976, personal health care expenditures increased almost twelvefold from $10.4 billion to $120.4 billion. Ten percent of the federal budget is now spent on personal health care, almost $34 billion in 1976 alone.

2 Health Systems Agencies were created as part of the National Health Planning and Resources Development Act of 1974. Their mandate is to improve the health of the American people: continuity and quality of health services; restrain increases in the cost of providing health services and prevent unnecessary duplication of health services.

3 In a recent survey by the American Health Planning Association, health planning agencies across the country reported that in one two-year period they were instrumental in preventing over $3 billion in capital investment for health care facilities. It's also important to note that there have been no indications that the quality of medical care has been impaired by their efforts.

4 It's estimated that 100,000 short term hospital beds stand idle—an idle bed costing almost 60% as much to maintain as one in use. Blue Cross recently noted that health care providers in southern California are reported to have ordered or installed enough $500,000 CAT scanners to serve the entire western United States.

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Buried up to the neck in warm mud, two devotees of the national pastime sweat it out in a Beppu bath.

By S. Chang

The Japanese love to bake themselves in Beppu's 'hells'

Proving that geothermal energy can be fun, devotees of the islands' many steaming springs swelter in hot water, mud and coffee beans

The headbands are of toweling, tied around the head to protect the eyes from cascades of perspiration.

By jet only an hour from Tokyo, the city of Beppu, says its mayor Nagayoshi Wakiya, is "a tiny edition of Miami, Florida." Its population is only 140,000, but the mayoral summation refers to his town's utter dependence on tourism. In one way or another, as much as 80 percent of the population depends on the tourist trade for its livelihood. And that trade is booming, thanks to the almost 12 million souls who annually turn up from around Nippon and from overseas to sample the superheated glories that Beppu offers.

The attraction that draws them is "the waters," which pour forth incessantly, abundantly, from the geothermal source under the town. The Japanese adore hot water, will go anywhere to find it, and their adoration for it is not just an infatuation but a lifelong love affair.

In 1900, for example, Tokyo had close to a thousand public baths and perhaps half a million people used them every day, preferably at least twice a day. Then, as now, the sexes were segregated for the most part, but the bathing ritual for either sex has remained something for a foreigner to behold. The bather washes carefully and then rinses off *before* entering a bath (considered ideal when its temperature is around 110 degrees F). One stays immersed as long as one dares, then emerges to dry off with *damp* towels. As one result, it is as true today as when Basil Chamberlain said it three-quarters of a century ago: "A Japanese crowd is the sweetest in the world."

What Beppu's got that Miami hasn't

Musing again about Beppu's kindredness with Miami, Mayor Wakiya says, "We do have plenty of sunshine," and sure enough, this amiable man, full of promotional spirit, has been toying with a "very, very tempting idea." He would like to strike up a sister-city tie-up "with that glorious city of Miami." But then, Wakiya adds quietly: "Perhaps we're too tiny to be accepted as a sister-city candidate to such a big place as Miami."

Such humility is outlandish. (Miami *is* a big place, but Mayor Wakiya is probably thinking of the resort area of Miami Beach, which has a population of only 87,000.) Hard by the glittering Bay of Beppu, the city, for most of the daylight hours, might look reposeful enough and peaceful, too. But the essential business of the city is tourism. Consider Beppu's amazing concentration of 850 inns and hotels. Around the clock, observes a city hall official, these compete, tooth and nail, for more clients.

Beppu's commerce and its whole life depend on something of which Miami has nothing: *onsen* (hot springs). Highly volcanic in geophysical structure, Japan is dotted with no less than 1,600 *onsen* spas, some almost bizarre in their ingenuity. On Honshu's Wakayama peninsula, one hotel offers hot-spring baths in a cable car that zips over a gorge (pp. 100-01). And in Ibusuki, a seaside resort south of Beppu, *onsen* devotees are "buried alive" in sand, each with a personal umbrella (pp. 100-01). But none of Japan's *onsen* resorts can come anywhere near the scale and scope of Beppu. Every 24 hours, more than ten million gallons of scalding water gush forth from underground. Its

Photographs by Paul Chesley

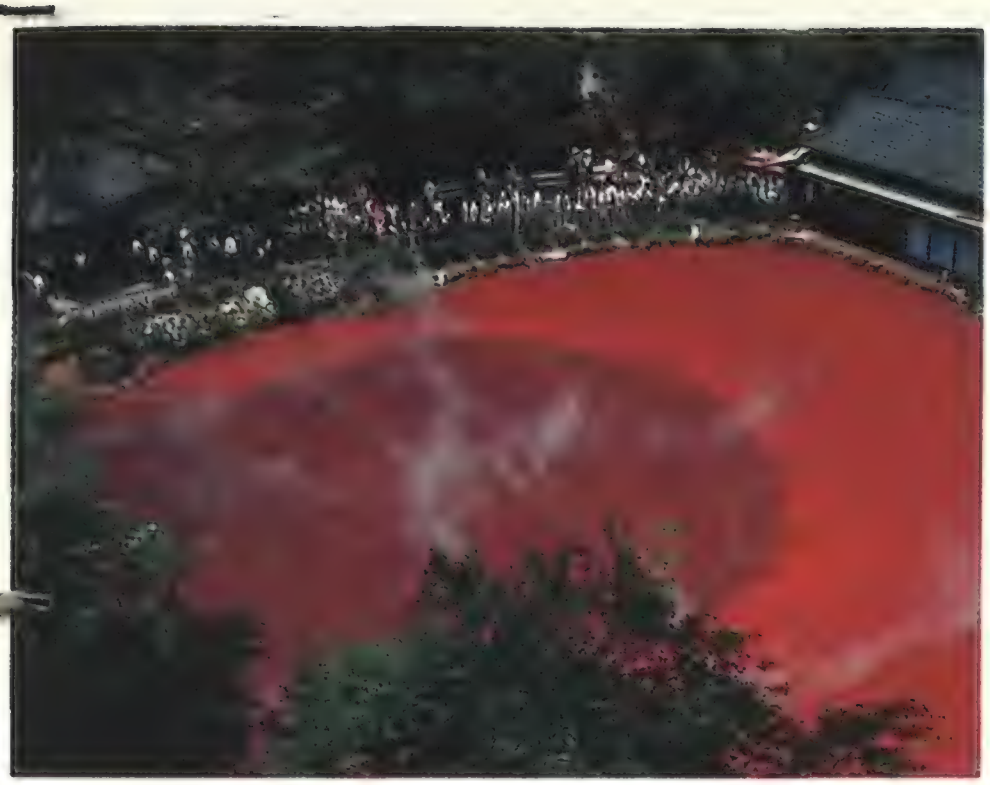
In Kannawa, oldest neighborhood of Beppu, a stroller looks out over the steaming cityscape.

Male bathers in Suginoi Jungle Bath contemplate statues of "medicine Buddha" and mother and child.

sources number 4,000 within the city limits alone. Not even an expert at Kyoto University's Geophysical Research Station in Beppu could withhold a sense of amazement. "This city is like a floating world," says Professor Kyozo Kikkawa. "It's smack above one hell of a hydrothermal field."

Hell is the word for it. That boiling, sprawling field beneath Beppu apparently assumed most of its present characteristics in A.D. 867, when Mt. Tsurumi, 4,500 feet high and now a dormant volcano at the back of the city, blew its top. Beppu's geophysics continue to leave many of its visitors awed. Among the most awesome are the colored boiling ponds called *jigoku* (literally, hells). Chi-no-ike Jigoku (Bloody-Pond Hell) is totally vermilion, a telling reflection of iron oxide's presence in its bubbling emission (p. 99). Adjacent to it is Umi Jigoku (Sea Hell). This one is emerald and blue because of the water's complex mineral ingredients (p. 99). Like all other hot springs in and around Beppu, these *jigoku* trace their sources to the same thermal field some 800 feet under the city. The temperature down there often stands twice as high as the boiling point. Even at the surface of some *jigoku* it is close to 212 degrees F (100 degrees C). Sturdy fences make it impossible for even the most daring of inquisitive souls to come into physical contact with the blanching *jigoku*. (But for the purposes of suicide, the preference over the centuries has been for steamy Umi Jigoku, almost 200 degrees F and believed to be 400 feet deep.)

A parade of enterprising Beppu city fathers has long tried to tame *jigoku* and champion the cause of



Busloads of tourists gawk at Bloody-Pond Hell, reddened by iron oxide in the near-boiling water.

Eggs are lowered into Umi Jigoku, or Sea Hell, also called Emerald Pond, where water is ultra-hot 200 F.

energy conservation. Not far from Umi Jigoku, a "hell" has been converted into an energy source for heating a zoo. The Hot Spring Utilization Agricultural Station, owned and operated by Oita Prefecture (in which Beppu is located), places its emphasis on horticultural studies. Acres of tropical plants and flowers are grown in massive greenhouses that are kept warm with heat from right under the city.

The institute's experts are delighted with the city's seemingly inexhaustible supplies of "free energy." One knotty problem, though, confronts them: quick erosion of heating pipes by the sulfuric *onsen* water. Sulfur-resistant tubes could be installed, but, for now, most of the heating pipes used at the station are of less expensive regulation steel.

No such problems are encountered where the time-honored benefit of *onsen* is concerned: bathing. Says Mayor Wakiya: "Beppu spells but one thing to Japan as a whole: it's a mecca of *onsen* bathing." Not surprisingly, almost none of the multitude of hostelries is without an *onsen* bath of its own. The largest of them all, Suginoi Palace Hotel's Jungle Bath, is truly heroic in scale. Consisting of two enormous sections—each akin in size and structure to an ample indoor gymnasium—its bathing area measures a stunning 1.6 acres, easily the world's most extensive hot-spring bathhouse. In its steamy interior with all its gaudy decor and trappings, you could even "bath-crawl." Almost endless is its series of poollike, but shallow, tubs, each one brimming with limpid *onsen* water.

Throughout there is a display of tropical plants, hence the name of Jungle Bath. The most exotic of the facilities is tailor-made for coffee fiends—a pit filled with crunched bits of coffee beans (p.102). In it, you bury yourself up to the neck, and a biting dose of *onsen* water from the pit's bottom, combined with the heady fragrance, is unforgettable. I tried it out one evening. Result: a minor case of insomnia. Somehow, I felt as though my skin—all the way from toe to neck—had refused to sleep.

Kannawa, the oldest of Beppu's *onsen* districts, presents the other side of the story. For decades, it has served as a rendezvous for "purist" *onsen* devotees. Its tortuously winding alleys are lined with small and unpretentious inns. Each with its own *onsen* bath, these inns are invariably friendly in atmosphere. The rates are reasonable, some as low as five U.S. dollars a night for a neat room with its comfortable *tatami* (straw mat) floor. Kitchen utensils are provided free, so that clients may cook—by means of *onsen* steam—meals to their own liking.

Early in the morning another institution of Kannawa opens, a roadside market. Here tourists in their relaxing *yukata* (informal kimono) shop for eggs, vegetables and delicacies for their own meals. Many Kannawa habitués make their stay a long sojourn—sometimes for weeks on end. Night life is almost nonexistent. After dark, Kannawa's sojourners dine together and settle down for a long evening of pleasant conversation and almost endless rounds of green tea. Before climbing into their *futon* (Japanese beddings

S. Chang, a correspondent in Time *magazine's Tokyo bureau, tried out Beppu's baths for himself.*

that are spread over the *tatami* floor) for the night, they take another plunge in their favorite *onsen* bath. Hot water is everywhere; the kids of Kannawa often cook eggs in steaming cracks of unpaved road.

So prevalent are hot springs in Beppu that the varieties of bathing bliss seem endless. At many hotels, a mud bath is available where you take a dip in a tub filled with tepid *onsen* mud. I tried it out one afternoon and came away with mixed impressions. The first contact with the murky, liquid mud proved definitely uncomfortable. But soon the mud began imparting a singular warmth. In no time would it become "imperative to feel either like a Zen monk or an existentialist philosopher," as a dedicated mud-bath aficionado puts it.

Offered on the beaches of Beppu, the sand bath is the point of takeoff for Suginoi's coffee bath. Once you climb into a *yukata,* attendants dig a hole for you

Sky bathing near Arita: a group of women ride a cable car, sitting in bathtubs filled with hot water.

"Peach Boy" or Momotaro, folk-tale hero born out of a peach, is part of decor at Jungle Bath.

Heads shaded, bathers at Ibusuki take a "dip" in sand made "exhilarating" by hot mineral water.

in the sand and cover you up to the neck with more of it. Within a few minutes, a hot emission of *onsen* water from under you could make this a short *vie en rose,* so you are dug out fast.

History is long and colorful here. Even Japan's mythology seems to have cooperated with Beppu. A passage in a mythological chronicle tells of a god named Sukunahiko. One day he was about to drop dead because of an acute illness when a fellow god—Japan then was full of them—plunged him into a Beppu hot spring. Outcome: "Instantly was the dying god revived." Composed in the ninth century, a regional gazetteer goes into unabashed rhapsodies over the benefits of Beppu *onsen.* "You take a dip in it, and you look more attractive than ever," breathlessly notes the ancient writer. "You take another, and you suffer from no illnesses for the rest of your life."

What you don't take, with your dip, is a drink from the hot springs. This rule was set as long ago as the 13th century by the monk Ippen. Perceiving the "medicinal values" of *onsen* (for external use only), he treated in Beppu a contingent of samurai wounded in a battle against invading Mongols. Ippen made his patients repeatedly dip in the divine water from the bottom of the earth, and apparently it worked.

But does the water really prove medically effective—and why? Confronted with such blunt questions, Professor Masashi Nobunaga smiles broadly. He is one of the six Kyushu University professors who jointly head a staff of 160 research and administrative personnel at Beppu's Research Institute of Balneotherapeutics, the largest center of its kind in the world. Of course, his answer, when it comes to those questions, could only be yes. "When properly taken," he says, "a dip in *onsen* promotes circulation, stimulates hormone glands and produces effects that, I

Elaborately tattooed patron of Jungle Bath, in Hotel Suginoi, goes through morning shaving ritual.

Youths just emerged from "coffee bath" wash bits of crunched, fragrant coffee beans from their bodies.

At a king-size aquarium, boy bathers admire koi, or ornamental carp, symbol of healthy youth.

would generally say, prove beneficial to the bather."

The institute was opened in 1931. Its charmingly designed hospital is unequaled in its array of baths: kinetic bath, steam bath, walking bath, whirlpool bath, electric water bath, hot packs and paraffin bath. All of them take advantage of the "divine" water. The hospital's clinical emphasis is on the rehabilitation of arthritis and rheumatism patients. The accidentally crippled also are put through the variety of baths for their rehabilitation. Professor Nobunaga has studied most of the outstanding spas in the United States and Europe, including Yellowstone, Carlsbad (Karlovy Vary, Czechoslovakia), Baden-Baden, Aix-les-Bains and Vichy. To him, Beppu's *onsen* are notable for two reasons: the low level of their chemical ingredients, such as hydrogen sulfide and sodium sulfate, and their high average temperature. "It stands at a striking average of almost 160 degrees F or 70 degrees C," he says. "It's rare to find such *onsen* among most of the historic spas outside Japan."

In the heart of Beppu is a monument dedicated to the memory of its champion promoter: Kumahachi Aburaya (1863-1938). By the time he was 30, Aburaya had already made his first fortune, as an Osaka stock-market "genius." But the money game, according to his biography, left him bored. Setting out for America before the turn of the century, he was converted to Christianity. The denomination to which he belonged is not clear. Clear enough is that once back home, he found for himself a new mission, that of promoting Beppu, and he set about carrying it out with an evangelical fervor. In 1924, Aburaya became the first entrepreneur to have a completely Western-style hotel built in the city. By then he had begun annually dispatching "promotional caravans" around Japan—to sing the praises of Beppu. Thanks to his gargantuan public-relations efforts, Beppu began skyrocketing in fame. By the time he died, the roster of celebrities to visit his city included George Bernard Shaw and Charlie Chaplin.

Aburaya's brand of promotional spirit continues to make itself felt around Beppu today. In fact this is the first and the only Japanese city to be linked directly with its airport by a Hovercraft service. On the hilly fringes of the city, a brave new hang-glider center recently went into business. Perhaps the Miami area city fathers should be flattered by Mayor Wakiya's sister-city idea. Miami has the sun, and, to be sure, ocean beaches; now, if they could only find some hot springs for *onsen* bathing. . . .

Profusion of tropical plants and decorative animals helps make Jungle Bath a relaxing place to visit.

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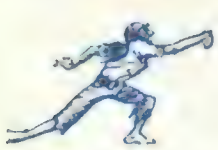

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Article and photographs by Peter F. R. Jackson

The body of Trilochan Paudel lies near Rapti River after dawn tiger attack.

Mourning villagers became even more upset when tiger got away for a day.

A tragic sequel: a son of Chuchchi kills a villager

Hurt and taken by surprise, a tiger (just a cub in our story two years ago) attacks teacher near Nepalese park

One day last November, Trilochan Paudel stepped out of his thatch-roofed house into the dawn light and headed across the fields of rice stubble toward the bank of the Rapti River. Beyond, above drifting patches of mist, the first rays of the sun tinted the snows of the Nepalese Himalayas. Trilochan, a 32-year-old Brahman who had come down from the hills to become a schoolteacher in the farming village of Madanpur, was going for his ritual morning bath.

As he approached the river, the head of a tiger suddenly appeared over the edge of the steep bank. Before he could turn to run, the tiger was upon him. It leapt at his shoulder with its forepaws and threw him to the ground, its huge jaws clamped round his head in a killing bite.

Debilal Shreshtha was also on his way to the river and saw the attack. He screamed. The tiger lifted its head and roared at him. Debilal ran.

From the window of his house Ganga Dhar Pandal heard the tiger roar and ran out to see it mauling a man. He screamed, too, and all the village ran out shouting as the tiger dropped its victim and ran off. When the villagers reached the river bank, Trilochan was already dead.

For the villagers, the horror of the incident was intensified by the legends of man-eating tigers that once had roamed the countryside, killing hundreds.

I had just returned from an early morning round of the forests in the Royal Chitawan National Park when news of the killing reached our camp at the Tiger Ecology Project. The messenger, who had

To record pattern of facial stripes—unique for each tiger—David Smith holds up Chuchchi's head for photograph. The tigress' eyes are still glazed from tranquilizing drug, but soon she will recover

In August 1978 issue David Smith holds head of Chuchchi, the mother of the killer tiger, after she had been tranquilized.

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Members of the tiger study team arrive by elephant at scene where villager was killed. Tracker in center studies pugmarks. Tiger is just 200 yards away.

walked four miles from Madanpur, told James L. David Smith, the co-principal investigator, that the tiger had a collar around its neck and was limping badly. We knew who it was.

"Tiger 119," said Dave. "It's the son of Chuchchi."

I knew the mother, Chuchchi, "The One with Pointed Toes," so-called because of her distinctive footprints; I had written about her in SMITHSONIAN in 1978. In fact, I had perched in a tree and seen Dave shoot her with a tranquilizer dart and then put a radio collar round her neck so that he could follow her movements as part of his study of tiger behavior. As Chuchchi was darted I had seen her cubs, then about seven months old, dash beneath my tree. In due course, when they were full grown, Dave darted one of them, put a radio collar on him and gave him the reference number 119. And now it was 119, Son of Chuchchi, who had tragically become a man-killer.

Dave's study of how tiger cubs disperse when they leave their mothers and have to find a place of their own in the tiger world is part of a research project into tiger ecology sponsored by the Smithsonian Institution and the World Wildlife Fund. The aim is to provide scientifically based recommendations on the size and management of viable tiger reserves, and on how to minimize conflict between tigers and Man.

Tiger 119 was one of the key figures in the study. When he was collared he was still with his mother, but had started to make his own kills. He was inexperienced, however, and often knocked down an animal without giving the coup de grace at once. It takes time for a tiger to become an expert killer.

He used to visit buffalo baits, but he was obviously nervous, always looking round, getting up from the kill and walking into the jungle. Then he suddenly disappeared, and Dave was worried, because he was still rather young to be going off on his own from his mother.

Later, Chuchchi gave birth to a new litter of cubs, and it looked as though she must have driven her grown-up son away. In similar cases Dave had found that cubs still stayed close to their natal area for some time. But 119's tracks were found on an island north of the Chitawan Park, where Dave had neglected to check.

"He must have been up there for several weeks," Dave commented. "It is not a very good area, with only a narrow bit of jungle. Some subadult tigers have used it, but there have been no residents. Two tigers have been poisoned by local people when they wandered outside the park into cultivated land."

Chuchchi's son did not linger in this unpromising area. He soon returned to near where he was born, and from there, over the next few months, he pushed out to explore new areas in his search for a territory of his own.

Last July, when the monsoon rains had begun to fall, he was down at the eastern end of the park, on Iturni Island, not far from the tiger ecology camp. Dave's expert trackers, led by veteran Prem Bahadur Rai, were maintaining their close vigilance on tiger movements despite the rains. They recorded several tigers visiting Iturni Island, including a big male, Tiger 126. It seems that one night, as he

The author, who described the tiger project in detail two years ago, wrote on Sri Lanka's elephants last April.

prowled the forest, the youthful son of Chuchchi met Tiger 126, who violently objected to his intrusion. There was a vicious fight.

When Prem and his trackers next saw Chuchchi's son, he was limping badly. Prem and Park Warden Tirtha Man Maskey decided to capture the crippled tiger to examine his wounds.

He had a huge open gash on the back of his upper left foreleg and shoulder, exposing the bone. They dressed the wound and put a buffalo carcass near him to eat, for he was emaciated from not having been able to catch prey.

Tiger 119 then moved to a patch of scrub jungle east of the park and began to wax fat again by killing domestic buffalo and cows. He was a nuisance and liable to be poisoned by the villagers, but there was hope that he would fully recover and move back into the park.

When dawn came on the fateful day, he was caught out in the open in the broad bed of the Rapti River, an exposed situation which no tiger likes in daylight. From the evidence of his tracks he was moving along the bottom of the steep bank below Madanpur village, and then turned up to go across the fields to the forest, about a mile away. It was at that point that he was confronted by Trilochan Paudel.

When Dave and I reached the spot, waiting villagers led us to the shrouded body of Trilochan lying by a large patch

Weak radio signals from collar forced trackers to use traditional skills.

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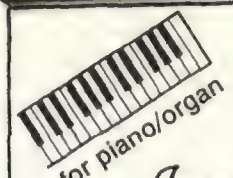
Hidden tiger is encircled by cloth in hopes it will hold him overnight.

of deep red caked blood on the yellowed rice stubble. One of the grief-stricken men pulled back the shroud revealing the bloodied head.

Meanwhile the trackers were at work, examining the footprints left by the tiger and sweeping the air with hand antennas to pick up the tiger's radio signal. He was there, not more than 200 yards away, hiding in dense bushes by a ravine leading to the river. Since the killing, people had been walking unwittingly close by him. Now we warned them away.

Dave got together with fellow researcher Dale Miquelle, Prem Bahadur Rai, and his co-principal investigator, Nepalese scientist Hemanta Mishra, to decide how to catch the killer. It was difficult to ensure that when the tiger was pushed out of the bushes he would move in the required direction for a shot. They decided that it was too risky to try to catch the tiger immediately. The problem was to hold the animal overnight, and so long strips of white cloth, normally used to guide a tiger to the tranquilizer gun, were unwound and set in a wide circle around the bushes where Son of Chuchchi was hiding. For some reason, a tiger usually will not jump over a cloth barrier as little as three feet high.

Prem and some of the trackers settled



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down to keep watch on the tiger for the night and the rest of us returned to camp.

During the night unseasonal rain began to patter on the roofs of our huts and it was coming down steadily when I joined Dave in the predawn darkness as he was preparing tranquilizer darts by the light of a lamp.

The low gray clouds were just lightening as we set off for Madanpur again, reaching the bank of the Rapti and then wading through the waters and struggling across sandbanks. In the distance the white cloth showed more clearly.

Prem came out to meet us. He looked very grave.

"The tiger got out of the ring a few hours ago and went off up the river. We have lost contact," he reported.

He told us that from about 6 P.M. the previous evening the tiger had started to move about, but had been deterred by the ring of cloth. But around 4 A.M. he had made a dash for freedom over the cloth, tearing it with his claws.

Prem's trackers were already checking for spoor on the sand of the riverbed. Sweeps with the radio antennas produced no signal from Tiger 119.

Dave climbed on an elephant with Prem and Hemanta and moved off. More elephants began to arrive to help the capture operation, their drivers hunched under dripping umbrellas.

Crowds of villagers stood around. The body of Trilochan Paudel lay on a rude green bamboo bier before a newly constructed hut of leaves and branches, from which a man emerged from time to time to chase away inquisitive stray dogs.

This tiger, 126, inflicted wound on Son of Chuchchi that eventually led to killing.

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On the back of an elephant, the tiger, still tranquilized, licks its lips while David Smith holds its head. Later it was taken by truck to zoo in Katmandu.

A priest blew into a conch shell and its sonorous boom added to the tense drama of the moment. Trilochan's wife and two young children mourned in their little house nearby.

Time went on. Dave and the trackers had disappeared upriver. Near Trilochan's body a man started to harangue the crowd, his voice rising.

"These people just let that tiger go off," he shouted. "They don't care about us. We are just dogs. But if we kill a tiger we get sent to jail. If they don't catch that tiger we shall hold them all here. And we won't move Trilochan's body until they get it."

Soon after, a distant shout brought news that the killer had been found. He

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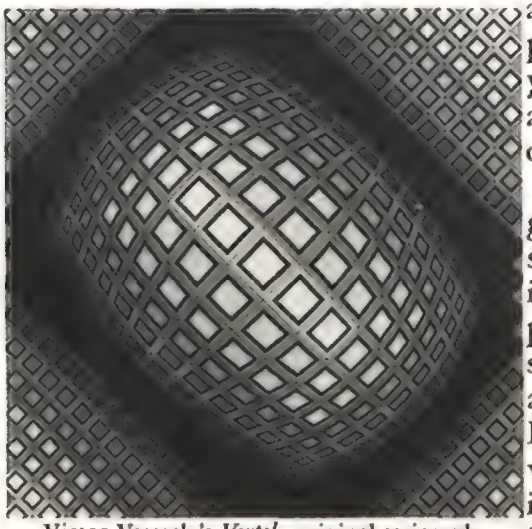

Victor Vasarely's *Vertch,* original serigraph. Signed limited edition of 250.

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Huertas Aguiar's *Birch Trees,* original lithograph. Signed limited edition of 195.

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There's a lot more to be learned about buying original prints, more than we can tell you on this page.

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Part of the wound on tiger's upper left foreleg is visible here. Animal was limping badly from injured leg after a territorial fight with Tiger 126 (p. 111).

had taken refuge in a thick patch of jungle about two miles away.

Now Dave and Prem began the most serious tiger drive they had undertaken. Dave took his place in a tree, with Hemanta Mishra backing him up with another dart gun nearby. Meanwhile, in deep silence, the trackers threaded the 300-yard-long strips of white cloth through the jungle to form a V-shaped funnel leading to Dave and Hemanta. When all was ready and the elephants were lined up at the wide entrance to the funnel Prem gave the signal for the push to drive out the tiger.

The elephants crashed noisily into the bushes, the trackers on their backs shouting and banging. As the elephants scented the tiger they began to rumble loudly and to trumpet. The signal coming in loudly on the radio receiver showed that, despite the tumult, Son of Chuchchi was reluctant to move at first. But eventually he got up and slipped through the undergrowth. From a distance another tiger was seen to run from the bushes outside the beat area and run along the riverbank. The watchers thought that Son of Chuchchi had escaped.

But Prem's strategy, born of hundreds of tiger hunts, again worked smoothly. Son of Chuchchi walked into a clear patch before Dave's gun, and in went the dart. With a loud "whoof" he took off, but within 100 yards the drug took effect and he dropped, his freedom at an end.

Dave bent over the prostrate form and examined the terrible wound on the tiger's left foreleg. It was red and raw looking, although tissue was forming in place of the missing skin. The elbow appeared to be immobile.

With a struggle the 300-pound tiger was lifted onto the back of an elephant, which despite its innate hatred of tigers, accepted the burden and stood true to its training. Then began the long procession to take Son of Chuchchi back to camp on his way to captivity in the Katmandu zoo.

As the column of elephants moved across the Rapti sandbanks and waded its many streams, Dave steadied the great head of the tiger.

Along the riverbank, and then out to join the procession came a stream of villagers, overjoyed at the removal of the menace from their lives. Gone completely was the tension and resentment which had mounted before the capture.

We reached our truck and loaded the tiger on the back. As we bumped along the cart tracks, passersby casually glanced into the truck, recoiling and shouting "Bagh, Tiger" when they saw the tawny striped form stretched there.

The previous night a cage had been

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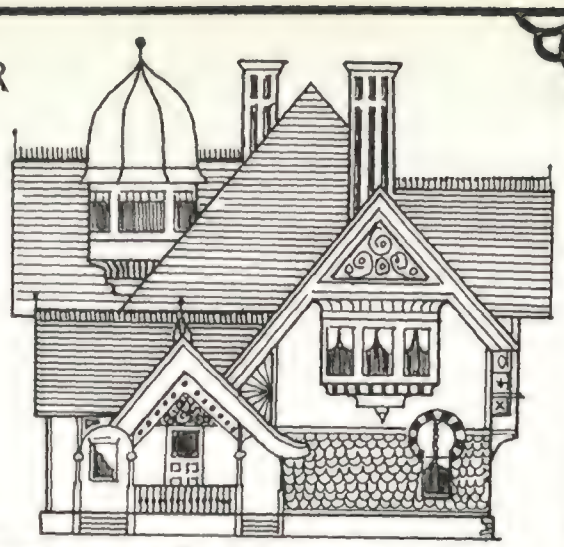

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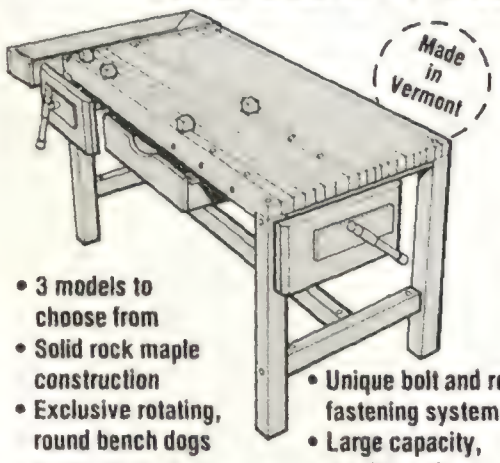

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prepared with a lining of sheet metal for the long journey over the mountains to Katmandu and Son of Chuchchi was laid on a mattress inside it.

It was 2 A.M. when Dave finally drove past the pagoda-roofed temples into Katmandu, too late to go directly to the zoo. He parked the truck in his garden and went to bed.

"I woke up at the sound of banging. It was about 5 A.M. and I thought it was probably a horse that is stabled nearby," he told me. "But the noise went on and finally I looked out to see the truck rocking and the tiger's face protruding from the crate. It had managed to push off one of the wooden bars of the door. A bit longer and it could well have got out."

Dave climbed onto the cab of the truck and gave the tiger another shot of tranquilizer, which put him out until he was safely in the zoo.

Coming to in the brick and barred cell, with two men staring in at him, Son of Chuchchi must have been terrified. He roared and angrily attacked the bars. He had to be shielded behind sacking curtains and a sheet of corrugated iron to quiet him.

A few days later, when I went to see him, he roared and snarled at me, but it

Enraged at captivity, tiger at first attacked bars and walls of cage. Here, several days

was apparent that he was reluctantly becoming reconciled to captivity. After a time he just glowered, then lowered his head and went to sleep. The wound which had brought him there showed red on his elbow.

Son of Chuchchi was not a man-eater, although he might have become one. It was an unhappy chance that he and Trilochan Paudel met that morning. Son of Chuchchi must have been very uncomfortable and irritable because of his wound and, taken by surprise, launched an attack. A single killing in such circumstances does not necessarily mean that a tiger will become a man-eater, but Son of Chuchchi was so badly crippled that it was a very likely possibility.

In earlier times, a tiger that had brought about such a tragedy would have probably been shot, rather than captured alive. But today the animals are so rare in the wild that a simple act of retribution would benefit no one.

And so Son of Chuchchi will live. There are many tigers in the zoos of the world, but there is a real need for new genetic material to maintain variability and prevent inbreeding within zoo populations. Son of Chuchchi may one day be able to add to that gene pool.

later, the animal, still in bad temper, is apparently accepting his confinement.

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Book reviews

What Is Art? An Introduction to Painting, Sculpture and Architecture
John Canaday
(Knopf, $30)

When he was art critic of *The New York Times,* John Canaday was almost unique in the New York art establishment of the time, 1959 and on. He wrote correct and effective English and, perhaps more threatening to his fellow establishmentarians, he actually described the works of art he wrote about. These two faults brought into being a cabal dedicated to getting him fired, presumably on the grounds that if people became aware that it was possible to write about art in language that conveyed some meaning in relation to works of art rather than to the process by which they had been created, the "risks" the artists took in making them, and the significance of the historical moment, then the jobs of all the cabalists might be in danger.

Canaday easily survived the attack, probably got a raise for it, and survived not only the cabal but the dominance of the mode it advocated, Abstract Expressionism.

Canaday advocated no artistic mode, was and is interested in all, was and is able to deal with all by the simple, though not easy, method of describing what is in front of him. He does this superbly in *What Is Art?* and comes as close as anyone can to answering that apparently unanswerable question.

Here's a sample. He is talking about the charming little Sassetta at Yale, *Saint Anthony Tempted by the Devil in the Form of a Woman:* "The saint, walking toward the door of his shelter, has just discovered the woman. In a wonderfully expressive attitude he hesitates, half turning toward her, his hand raised in a gesture of surprise that in the next moment can turn into a gesture of assent or one of rejection. He stands directly in the center of the picture, with the cell and the woman on either side of him like equal weights in a scale of which he is the pivot. The balance is emphasized by the fact that both objects offered him for choice are pink, the only bright color in the picture except the streak of light along the horizon. These pinks, however, clash with one another, the vermilion-pink of the shelter with the carmine-pink of the woman's robe. The woman is an exquisite little creature; the innocence of her pretty face and blond hair is denied by slits in her bodice and skirt; even her jeweled batwings are pretty, although they are hidden from the saint and revealed only to us. In contrast to the graceful and ornamental forms of the woman, the lines of the shelter are extremely severe."

There is more, but the point is that, clearly, Sassetta didn't miss a trick: everything carries its weight. No less clearly, Canaday didn't miss a trick. What I have been calling "description" in Canaday is simultaneously interpretation: we don't just know the pinks are in the picture, we know what they're doing there.

What Canaday does in the book is to apply this basic critical technique to group after group of paintings chosen from widely separated times and places. Similarities are revealed in pictures that look, in one sense *are,* worlds apart. As the analyses pile up, the reader is led, ineluctably and painlessly, into an ever firmer grasp of what art is all about, plus, as an inevitable bonus, at least some general understanding of art history.

There are chapters on sculpture and prints, on techniques and media, on the varieties and purposes of art and architecture. The book is richly put together, with details following overall reproductions as needed, all illustrations integrated with the text. The writing is lucid, the basic attitude civilized, the goal of the title just about achieved.

Canaday believes that every aspect of a work of art affects every other aspect.

Yale University Art Gallery, University Purchase from James Jackson Jarves

Sassetta shows the Devil, in the form of a beguiling woman, tempting St. Anthony.

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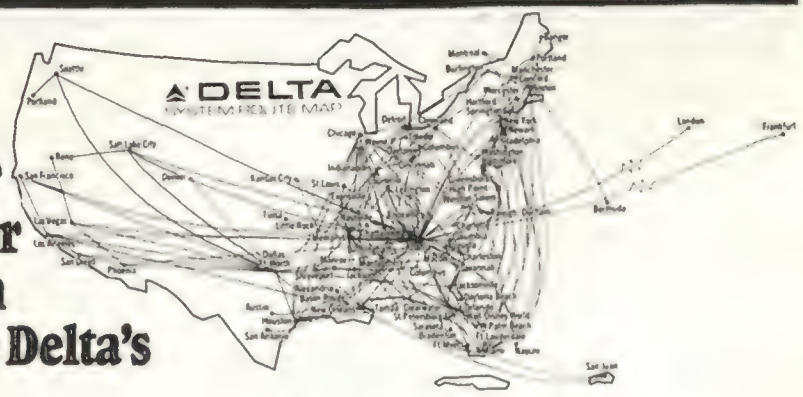

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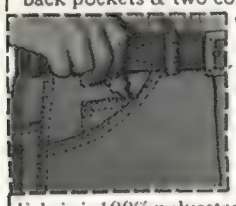

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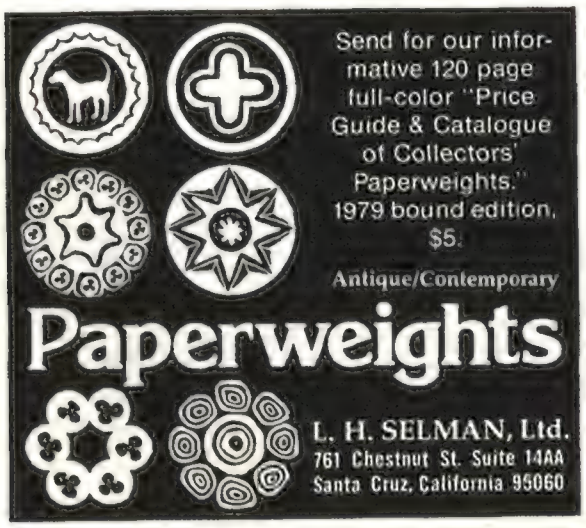

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—*Frank Getlein*
Critic and author

Three Farms
Mark Kramer
(Atlantic-Little, Brown, $12.95)

The true intellectual's obsessive pursuit of knowledge for its own sake is fascinating in any case, but when this insatiable collector also happens to be a good writer, watch out. The obsession is catching. Rachel Carson was one of these. Mark Kramer is another.

Kramer's *Three Farms* introduces us to a New England dairyman, an Iowa corn and hog farmer and a "farmerless farm" in California's San Joaquin Valley. We meet people, see them at work, learn who their grandparents were.

Then the author plunges joyfully into the details: the smart farmer deliberately bales his hay loosely, sloppily, so it can be thrown quickly into the loft and will fill up the odd spaces by itself, without the tugging and wrestling that a neat, hard cube of hay requires.

We examine the different kinds of grasses that make up the best hay and the ones that don't and why. We study cow bone structure and its development over the eons. We delight in the subtleties of pigsty architecture.

"It turns out that pigs like to be clean —in some senses—and unlike cows are aware enough of their bodily functions to stay clear of both their feed and their sleeping places. It also turns out that pigs like *a view* while they eliminate."

Therefore, the cunning pig farmer gives his charges one particular spot where they can gaze out, and at that spot he places open floor grates with the manure bin below.

"The pigs have been engineered into doing their own housekeeping."

But *Three Farms* is no mere compendium. It brings us close to some actual people, their hopes, their regrets, what they eat for breakfast. Kramer candidly lets us see his struggles to get closer to them. The Totman family of Massachusetts comes easiest. On the farmerless farm, mutual trust is so difficult that the author is reduced to using pseudonyms.

Still, there is no shortage of sharp observations even on the megafarm. A tomato harvester points out that longer rows are more efficient for the machines carrying crews of Mexican cullers.

"When you get to the end of a row," he says, "the machine here has to turn around before it can go back the other way. And that's when people get off and smoke. Long rows keep them on the job more minutes per hour. You've got less turns with long rows, and the people don't notice this."

This appealing chronicle defends its judgments. The conclusions are all but overwhelmed, like a $20 diamond in a fancy setting, by supporting evidence.

"In the past half-a-dozen years the once spectacular progress made by the soil conservation service, following the dust-bowl days, in introducing strip cropping and contour farming, has to a large extent been eradicated by the press of short-term economic need. Big combines turn awkwardly. . . . If every field a farmer plows must have wide end aisles for maneuvers and roads along its sides, it obviously pays to remove obstacles and join fields together. . . . The result is soil loss. Iowa conservation officials estimate that hill land now loses about thirteen tons —two hundred and sixty bushels of soil per acre, per year."

Describing in relentless detail the disappearance of craft from farming, Kramer avoids the temptation to mourn. Poignancy would be so easy. Instead, he moves us with facts.
—*Michael Kernan*
Washington Post writer

The Games Players,
Tales of Men and Money
John Brooks
(Times Books, $15)

In times when a week of financial transactions is reduced to the summaries of the Federal Reserve's Friday money supply announcement, the individual seems a footnote in financial events. But scratch the Gross National Product, the Consumer Price Index, or any index you choose, and those unpredictable variables of economic transactions emerge—people. Business writer John Brooks, a veteran observer of the personal component in finance, calls those who participate in earnest, for high stakes, "the games players."

They play as individuals and in teams, testing the post-World War II field, with its developing terrain of multinational corporations and shifting world re-

sources. Robert R. Young, dapper, cherubic and 57, dazzles New York as he forces a high-profile proxy fight for control of the New York Central Railroad. He wins, and commits suicide less than five years later. The partners of Morgan Stanley & Co. underwrite a 1955 common stock offering for General Motors; genteel investment bankers sit in suspense at their traditional rolltop desks as they wonder if E. I. du Pont de Nemours & Co. will exercise its rights as a major GM stockholder to subscribe to new shares. If it doesn't will Morgan Stanley be at risk?

The games players are not always genteel, and sometimes they cheat. But Brooks shows how success, however nurtured, can breed legitimacy, as in the case of the Mallorcan ex-peasant, Juan March Ordinas. Brooks follows him from his smuggling days to his last gasconade, a boast which brought the skillful takeover of one of the largest companies in Spain, whose foreign owners had their day in World Court and lost.

Brooks discerns in March a trait which may explain why we can remain dispassionate about such as he. "One element of March's perverse genius was his ability to pick enemies who deserved him."

Not all the characters in Brooks' 12 chapters are perverse or geniuses, of course. The author's ability is in picking players whose roles often help us better comprehend the game. As interlopers at a junket sponsored by the sedate private bank of Brown Brothers Harriman & Co. for 92 world banking and industry leaders, we learn from a Swedish magnate how banking, like tennis, requires a "hard drive and soft lob." We see how to launder money for secret political contributions—trading envelopes in washrooms remains *de rigueur*—but watch the plot come out in the wash. We study the emergence of "the world monetary game of the nineteen-seventies," which began as the United States freed the dollar from the gold standard and was complicated by the 1973 OPEC embargo and the emergence of the realigned petrodollar.

As Brooks leads us into his fourth quarter, which covers the last decade, we sense less that the players' aims have changed than that the rules are different. Or, as the balance of world resources shifts, have we changed references? Yet, in the midst of devaluations and special drawing rights, elements of the old game endure. When Esso turns into Exxon, or New York University's School of Law survives on its pasta investment, Brooks is there, applying his skill in coloring transactions often perceived as black and white. Just as we wonder if the Western games player is on the sidelines—the recent roiling of the silver market tells us "no."

Finally, one can't help noting that Brooks' players are men, exclusively. Old men in particular favor financial machinations. Age, he feels, doesn't hinder the financial brain the way it does those brains keen for "mathematics, physics, chess and, quite possibly, armed bank robbery." Women have proved themselves occasional geniuses at financial speculation, but "seem never to have entered the arena of largescale financial predation." Without rooting for predation, we might hope as we enter the Eighties that the substance exists for more tales of women and money.

—Jourdan Houston
Business writer and cultural critic

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A report on the great American forest.

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Demand keeps rising.

Forest management like this is vital because every year Americans need more homes, more paper products, more packaging and containers, more fuelwood, more of the thousands of other essential products that only the forest can provide.

So far, the country's commercial forest has been able to keep up with demand. (*Commercial forest,* as defined by the U.S. Forest Service, is *all* forestland—whether owned by individuals, government or the industry—that is capable of, and potentially available for, growing repeated crops of trees for harvest. It includes land in National Forests but not in National Parks or Wilderness areas.)

But trees aren't grown equally fast by all commercial forest owners. Though industry has made striking advances on its lands, productivity is lower on privately owned lands and seriously lagging in National Forests.

Productivity not up to potential.

Overall, the U.S. Forest Service estimates average productivity of all commercial forestland is only 61 percent of potential. And at the same time, actual acreage in commercial forests keeps shrinking, as land is withdrawn for homes, highways and other needs of an expanding population.

So we as a nation still have a long way to go if our wood and paper products are not to become scarce and expensive.

If you'd like to be better informed on how important it is to keep America's forests productive, write American Forest Institute, P.O. Box 873, Springfield, VA 22150 for a free booklet, "The Great American Forest."

The great American forest. Trees for tomorrow. And tomorrow. And all the tomorrows after that.

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Smithsonian highlights

A July 4th naturalization ceremony for 30 new American citizens in the Museum of History and Technology will be only one of many special events planned for Smithsonian's traditional four-day celebration, July 3-6. A complete schedule of activities, that begin daily at noon, is available at MHT. A few samples: fireworks making, campaign oratory, paper boat workshop (with pool), folk dancing in the evenings, puppet shows and daily showing of *Yankee Doodle Dandy.*

On July 4 at 4 P.M. the Declaration of Independence will be read, followed by a brass band concert. Dusk brings the spectacular fireworks display on the Washington Monument grounds. Regulars report the Mall is crowded but there's always room for more.

Special July events

Museum of History & Technology (MHT)
July 4th Celebration (July 3-6)—Above.
Western Visions-Eastern Views (July 31-January)—Original works of U.S. Geological Survey photographers and others documenting wilderness in 1860s-80s.
Puppets and Things on Strings (through September 8)—Some famous entertainers.

Air and Space Museum
Douglas-Norththrop Legacy Exhibit—New exhibit features military and commercial aviation work.
The Milky Way Galaxy (July 5, 9 A.M.)—Free monthly sky lecture.
New Eyes on the Universe—Space-age astronomy is subject of new spacearium show, daily, every 45 minutes.

Freer Gallery of Art
Year of the Monkey (through September)—The monkey in Oriental art.
Japanese Fans (through September).
Chinese Calligraphy (through November 10)—Treasured scrolls and rubbings.

Hirshhorn Museum & Sculpture Garden
Art Deco Posters from the Collection of the Library of Congress (July 31-October 5)—American and European works.
Brancusi as Photographer (through August 10)—Prints taken by the sculptor.
The Fifties: Aspects of Painting in New York (through September 21).

Museum of African Art
Selections from the Permanent Collection (through October 19).
African Puppetry (through September 30).

Museum of Natural History (MNH)
Farallon Islands: A Conservation Success Story (July 26-September 21)—Photographs of wildlife (p. 125).
Year of the Coast—Free ecology films Fridays, Saturdays; call 357-2700.
Noon lectures—"Beach and Marsh Birds of Atlantic Coast," July 11; "The Rocky Mountains," July 18.

National Zoo
Zoodles (Tuesdays-Sundays, 10 A.M.-4 P.M.)—Summertime puppet shows.
Zoo Films (daily, 10:30 A.M.-4:30 P.M.)—Ongoing films on zoo life, conservation.

U.S. birthday reminder at MHT

National Portrait Gallery
Portraits of George and Martha Washington by Gilbert Stuart—Famous portraits, both unfinished, go on display July 4.
Unsuccessful Candidates for the Presidency, 1912-1976 (July 3-November 9).
Zelda and Scott: The Beautiful and Damned (ends December 1).
American Portrait Drawings (through August 3)—From 18th century to present.

National Collection of Fine Arts
Max Weber: Prints and Color Variations (July 11-October 5)—Abstracts.
Across the Nation: Fine Art for Federal Buildings, 1972-1979 (through September 1)—Maquettes, paintings, drawings represent commissioned art.
Violet Oakley: Art and Decoration (ends September 14).

Smithsonian events

Special events in July are listed below. For tickets, call 202-367-3030.
Masterworks of Bronze Age China (July 1, 8 P.M., MNH)—Lecture on recent archaeological finds by expert Robert Bagley (SMITHSONIAN, April 1980).
Festival at Mizumi: A Japanese Celebration (July 2, 8 P.M., HM&SG)—Film.
Great American Ships of the 19th Century (July 9, 8 P.M., MNH)—Talk by maritime preservationist Nicholas Dean.
Koko, A Talking Gorilla (July 10, 8 P.M., MNH)—Feature-length documentary.
Brass in the Courtyard (July 17, 7 P.M., NCFA-NPG)—Concert by Washington Saxhorn Ensemble.

Membership benefits when visiting the Smithsonian

For current information on events and a special publication, come to the Associates Reception Desk in the castle, 10 A.M.- 4 P.M. daily. Also in the castle, the Associates Lounge is open until 9 P.M.

For an orientation of the 13 Smithsonian museums, attend a 30-minute slide-talk in the Discovery Theater, Arts & Industries Building, at 10:30 A.M. daily.

For dining, enjoy the Associates Court, Museum of Natural History.

For previsit information, send postcard or phone Associates Reception Center, Smithsonian Institution, Washington, D.C. 20560 (202-357-2700 or, for hearing impaired, TTY 202-357-1729). Allow two weeks for receipt.

Smithsonian Institution Traveling Exhibition Service

SITES circulates exhibitions to hundreds of cities outside Washington, D.C. To sponsor a show in your community, write to Eileen Harakal, SITES, Smithsonian Institution, Washington, D.C. 20560. Here are some July exhibits:
Birmingham, Alabama (July 19-August 31)—*The Working American,* Birmingham Museum of Art.
Tampa (July 12-August 10)—*Edison and the Electrical Age: 100 Years,* Department of Museums.
Chicago (July 12-August 10)—*Early Chicago Architecture;* (July 19-August 17)—*America's First Ladies,* Public Library.
Davenport, Iowa (July 5-August 10)—*Louisiana Music, 1840-1940,* Putnam Museum.
Trenton, New Jersey (July 12-August 24)—*Sèvres Porcelain,* N.J. State Museum.
Philadelphia (July 19-August 27)—*Crosscurrents: Neoclassical Drawings and Prints From the Cooper-Hewitt,* Philadelphia Museum of Art.

The Farallons breed success

About 30 miles off the coast of San Francisco is a group of islands strictly for the birds, seals and sea lions (right). Billed as "a conservation success story" in a Smithsonian traveling photographic exhibit now at the Museum of Natural History, the Farallon Islands are the largest North American seabird rookery south of Alaska.

The islands' wildlife population was once nearly decimated, threatened by commercial egg collectors, seal hunters and a lighthouse with its residents and domestic pets. Today some 260,000 birds and 3,000 marine mammals find refuge.

The return of birdcalls and sea lion barks is a tribute to the U.S. Fish and Wildlife Service and other conservation groups. One significant move was to close areas to visitors in the late 1960s. "There's no room for people there," said one official. "I once visited and had to follow in someone's footsteps in order not to step on a nest. Some are so close together—one misstep and you hit baby birds."

Burr Heneman, director of the Point Reyes Bird Observatory (PRBO) which maintains a research station on the Farallons, said that one disturbance at the wrong moment could seriously set back productivity for some species for an entire breeding season. "People wandering around in a rookery scare the adult birds; they leave their chicks and the gulls move in." The Farallons also constitute the largest western gull rookery in the world, with a population of 35,000.

From April through August the rocky islands provide nesting space for 11 species of seabirds and one shorebird, the black oystercatcher. The common murre population, estimated at 6,000 in 1959, is now about 60,000. After a lapse of 100 years, the rhinoceros auklet resumed breeding on the Farallons in 1972; there are now 120. Figures also have climbed for the tufted puffin, pigeon guillemot, Cassin's auklet, and a few species of petrels and cormorants.

Today the islands are peaceful. A few PRBO biologists band birds, carry out research and protect the wildlife from harassment. On Saturdays supplies are dropped off by volunteer skippers of the Oceanic Society. The U.S. Coast Guard maintains the lighthouse. Sometimes special groups come to study island life.

Years ago people used to boat over to collect eggs or take potshots at the wildlife. "But people don't do that anymore," commented Heneman. "Maybe it's because the islands are protected. But maybe it's a changing consciousness."

—Carol Simons

Tufted puffin is flashy Farallon regular.

Pigeon guillemots nest in rock crevices.

Many harbor seals reside year-round.

California sea lion population is up.

Photographs by Tupper Ansel Blake

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Williamsburg Family Weekend—August 14-17: A repeat of our popular program for children 7-14 (and parents) to learn about 18th-century life through participation in Colonial activities.

Chicago—September 17-21: Discover the architectural treasures of this vibrant city with tours and lectures by Chicago Architecture Foundation staff.

Hawaii—September 30-October 9: Study the natural history of the "big island" with its volcanoes and lush orchid gardens.

California Wine—October 5-11: Visit selected vineyards for tasting, lectures and discussions with distinguished wine masters.

New England Seaports—October 10-18: Trace the fascinating history of 19th-century American China trade in Boston, Newport, Providence, Salem and Kennebunkport.

Savannah/Charleston—October 13-20: The architecture and decorative arts of these charming seaports are discovered through tours and lectures.

Smithsonian Sampler Weekend—October 24-26: Curators and staff conduct behind-the-scenes tours of specially selected museums.

The Florida Keys: A Tropical Wilderness—November 2-9: An active program offers snorkeling and field trips to explore Big Pine Key and colorful coral reefs of the Gulf Stream.

Philadelphia—November 5-9: This historically rich city enables us to trace the origins of our nation; includes visits to homes in Society Hill, Rittenhouse Square and Fairmont Park.

Sapelo Island—November 9-15: Camp on unblemished beaches while studying the marine ecology, Indian ruins and history of this Georgia Barrier Island.

Washington "Anytime" Weekend: Choose any weekend to visit your choice of Smithsonian museums, spend two nights at Loew's L'Enfant Plaza Hotel or Hyatt Regency Washington, each close to the Mall, and see other sights in the city by Tourmobile. Reservations and payments at least ten days prior to arrival.

Foreign Study Tours

These tours range in size from small group experiences to charter adventures and vary in price from low cost to deluxe, depending on the type of travel, destination visited and length of trip:

Iceland: Land of Fire and Ice—August 3-17: Travel a rugged terrain of glaciers, hot springs, fjords and waterfalls. Visit fishing and farming communities to meet today's pioneers of the far North.

Scandinavian Passage: Fjords and Capitals—August 8-23: From Bergen, Norway, cruise magnificent Nordfjord and Sognefjord aboard the *World Discoverer.* Continue to Copenhagen and Visby, Sweden, then cruise the Baltic, calling in at Leningrad and Tallinn before returning to Stockholm.

Oxford/Smithsonian Seminar—September 12-27: An exciting array of subjects is taught by Oxford University faculty. Field trips and special seminars utilize the rich resources of the town and countryside, the Ashmolean Museum and Bodleian Library. Live in Worcester College and enjoy the special ambience of this ancient school.

Canadian Rockies—September 15-24: Snow-capped peaks, blue-green lakes and alpine forests provide scenic grandeur for hiking and studying the natural history of Banff, Lake Louise and Jasper.

Spain*—September 14-28: Explore the fine museums and historic buildings of Madrid, the glorious cities of Toledo and Segovia, plus the varied beauty of the Andalusian countryside.

Adriatic Shores—September 19-October 6: From Athens, cruise both shores of the Adriatic Sea aboard the *Argonaut.* In Italy, visit churches, museums, palaces in Brindisi, Bari, Ravenna, Trieste and Venice. Explore walled cities of Dubrovnik and Split on Yugoslavia's Dalmatian coast, and the Greek Island of Corfu.

Paris & French Countryside*—September 21-October 5: Combines the best of old and modern Paris with museum lectures, walking tours and day excursions from the city followed by a choice of week-long travel to Alsace-Lorraine, Provence, or Normandy and Britanny.

The Land of Eire*—September 28-October 12: The treasures of history, architecture, folklore and awesome scenery are savored in this circle tour of the Irish Republic. Three days in Dublin include meetings with university and government leaders, special lectures and receptions.

Kyoto Seminar—October 17-November 2: A unique program to study Japanese culture and to live in Japanese style in this medieval capital. Japanese and U.S. scholars lead seminars, field trips and special events.

India Wildlife Safari—November 16-December 9: Visit major wildlife sanctuaries to observe the magnificent animal life of the subcontinent. Travel to parks from Central India to Assam; also included is Nepal's famous Tiger Tops.

Antarctica—December 31, 1980-January 20, 1981: Prominent lecturers make this a rewarding expedition to a powerful continent. Cruise aboard the *World Discoverer* from Punta Arenas, Chile, to the Falkland Islands, then down to Antarctica.

Winter Baroque—Vienna, Salzburg, Munich—January 4-18: Winter provides an enchanting setting for walking tours of Baroque Vienna and picturesque Salzburg, guided visits in the famous museums of Vienna and Munich, and special music performances.

New Zealand—February 18-March 6: Tour includes Mt. Cook, Te Anau and Milford Sound, plus Auckland, Rotorua, Wellington, Christchurch; talks on natural history, Maori heritage, Parliament and a home visit.

Coming in January and February: **Mayan Mexico, Guatemala and Kenya.**

* Indicates optional predeparture course.

Write National Associates, A&I 1278, Smithsonian Institution, Washington, D.C. 20560 for specific tour/seminar brochures or call (202)

in Washington

Selected Studies Seminars

Come and enjoy a popular new low-cost program at the Smithsonian which combines outstanding speakers with small specially arranged tours "behind-the-scenes." Choose from:

Tibet: Lost Horizons—Sept. 28-Oct. 3: A cultural history of a uniquely rich civilization. Includes tours of the Freer Gallery of Art and the best private collection of Tibetan art in the U.S.

China: A Cultural History—Oct. 5-10: Prehistory to the enigmas of today, with emphasis on the intellectual and artistic traditions and the great philosophies and religions. Includes recent films and tours of the Freer Gallery of Art.

Historic House Preservation—Oct. 19-24: Experts advise on how to work with architects, contractors and other professionals; explain mistakes to avoid and how to save money; and lead tours of lovely Georgetown, Old Town Alexandria, as well as famous country estates.

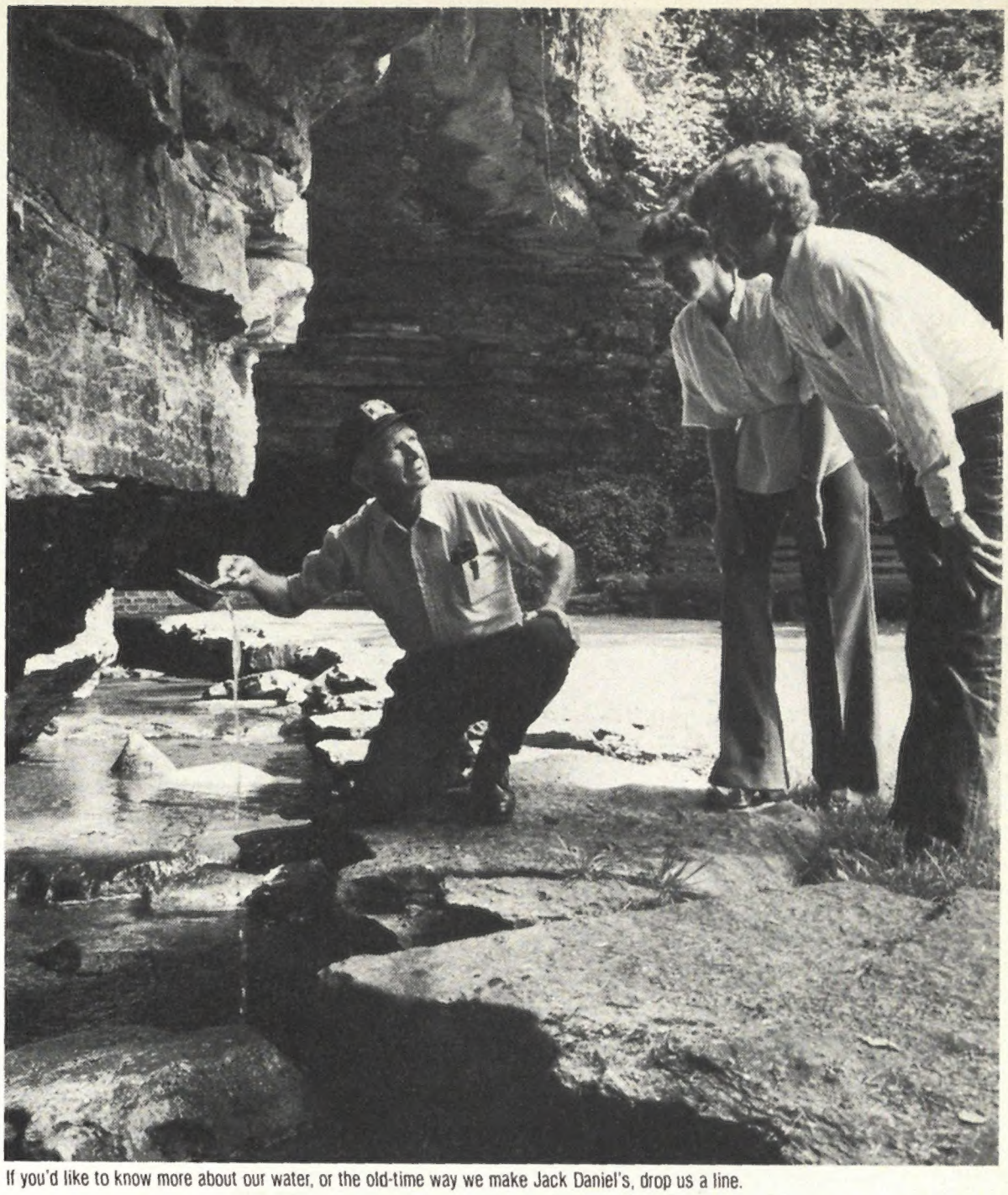
Aircraft Restoration: How To—Oct. 26-30: Internationally known craftsmen who have restored the famous masterpieces of aviation in the National Air and Space Museum offer workshops at Silver Hill on the many various techniques used.

Flemish and Dutch Painting in the 17th Century—Nov. 9-14: Princes and patriots with masterworks by Rembrandt, Hals, Vermeer, Rubens, Van Dyck and others. Lectures and tours of the National Gallery of Art with Bill Kloss.

World War II Aircraft—Nov. 16-21: Guest experts and the outstanding aeronautical staff of NASM offer new insights as they discuss how the major air forces of the world came into being and how quantum jumps in aviation production and performance were achieved. Includes tours of many of the only surviving World War II planes.

Genealogical Research—Nov. 16-21: Taught by the "dean of American genealogy," Milton Rubincam, Marilyn Duncan and other leading authorities, participants learn how to conduct research in major genealogical repositories such as the National Archives, Library of Congress and the DAR Library.

357-2477 (tours) or (202) 357-2475 (seminars).



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By Cyra McFadden

Rein in Spain falls mainly on the turistas

A little knowledge of a foreign language is a dangerous thing. If I didn't retain scraps of my high school Spanish, for example, I need not know that in Spain I have been labeled "the Denounced."

Boletin de Denuncia reads the traffic ticket that arrived by registered mail recently. Somewhere near Segovia, six months ago, I apparently exceeded the speed limit in my rented Renault—or so contends El Jefe de Trafico, who clocked me on radar and finally ran me to the ground here in California.

Spain is now a democracy; Segovia is 6,000 miles away and must have other business to attend to, besides bringing me to justice. I do not really anticipate the tread of heavy boots on my stairs, in the night, as the Guardia Civil comes to take me away for crimes against the state. Still, being denounced has shaken me.

Is my picture posted in the Segovia post office? Have the Renault people been alerted to look out for me, in case I slip across the Spanish border and strike again? Does it help that I sent a clumsy apology with my 500 peseta fine?

I wish I had not taken Spanish in high school, years ago. Had I taken French, I could have assumed *Boletin de Denuncia* was just another bullfighter announcing a comeback.

Not that English was a lot of help on that trip, either. Dictionary in hand, I could have translated Spanish menus; more often than not, however, the job had already been done, with baffling results. What is one to make of such offerings as "pork hands" and "potta vegetables?"

With no love for pork feet, I could not bring myself to order the pork hands. These I imagined curled pinkly on the plate, looking like babies' fists. As for "potta vegetables," how big was the pot? "Potta" sounds like a lotta. Would I be better off with a light lunch of "spit goose fish?"

Another menu proposed "mixe see food in whine seuse." I do not like food that stares back at me or complains, self-pityingly, about being eaten. Nonetheless I was warier yet of the house specialty, "reins with sherry."

Can some culinary expert tell me the proper method of eating reins? Does one cut them into pieces, or wind them around a fork, like very long, very tough spaghetti? Afraid I'd commit some breach of protocol, I settled for "small clans with garlic" instead, but still regret my cowardice. When will I get another chance, after all, to experience the rein in Spain?

"Roast baby, sucking pig" did not bear contemplating six months ago. It still doesn't. As for "Quail to the Grapes," that got me started humming *Hail to the Chief*. Since I am one of those unfortunates who can't get a melody out of her head once it is there, I spent a whole day marching to my own inner music.

"Grey fishes of shrimp" I suspected were another version of "mixe see food"; would they also whine? Were mere mortals allowed to dine on "Godfish"?

The most perplexing conundrum of all was a phrase in a Spanish newspaper story about the popularity of American disco music. A Donna Summer song, it said, was "Nember guan del Jiparei." No such nouns in my travel dictionary, and it took me days to crack the code—slow-witted of me, because anyone with a good language ear would have guessed right away that Donna Summer was Number One on the Hit Parade.

Back home in what my traffic ticket calls "M. Walley" (known to those of us who live here as Mill Valley), I have resolved to be less dictionary-bound next trip—if there is a next trip and I can go back to Spain, having been denounced. Perhaps I am what the translator of menus for tourists surely would render as *persona au gratin.*

If not, I intend to take a conversational Spanish class beforehand. Phrase books for travelers, even those not largely devoted to flies in the soup and missing buttonhooks, are simply inadequate for staying clear of the law, or even for routine whining and dining. Mine was no exception. Full of potential catastrophes, it provided sentences for "The bed is too hard," "These aren't my shoes" and "This isn't my laundry."

Karl Malden would have loved this book, which also included "Stop or I'll scream," "Get help quickly!" and "POLICE!" From now on I've decided I'll leave home without it.

At least the Spanish are kind about linguistic lapses—unlike the French, claims an indignant friend, who called the waiter in a Paris restaurant with *Gendarme!* and got himself resoundingly laughed at, not just by the waiters but by the other patrons.

A lingering trauma. I'd much rather be denounced.

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